

5th
ANNUAL NORTHWEST
RADIO SHOW

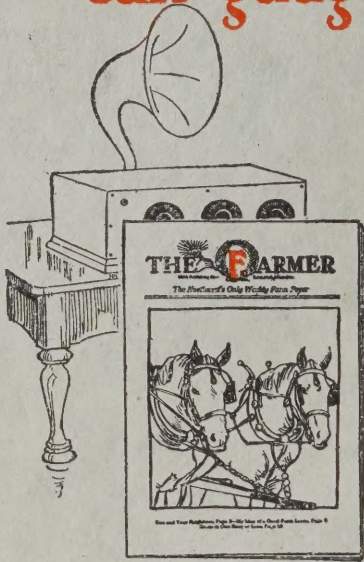


Year Book



NORTHWEST RADIO
TRADE ASSOCIATION

How Radio Dealers can gauge their Country Sales



Every week the Favorite Farm Paper of the Northwest reaches about half of your nearby farmers—the half that are aggressive and the best radio prospects. It carries many radio articles, programs, and stories on how to benefit from crop and price broadcasting.

Radio dealers of the Northwest can tell in advance how their sales efforts will be received by farm families by getting the answer to this question: Is the equipment to be sold advertised in **THE FARMER**? The reason this is so important is that practically one-half of all of the farm homes on each and every rural route in this district are subscribers to this weekly farm paper. For forty-three years it has been one of the important factors in agricultural life. Goods that are introduced through **THE FARMER** to this great mass of prospects are easier to sell. Readers of **THE FARMER** have confidence in things advertised because they know that no questionable advertising will be printed. They have been educated through numerous radio articles in this weekly and they look to it for up-to-date information regarding broadcasting programs and radio development. The good-will built up in **THE FARMER** by radio set manufacturers serves as a tremendously valuable sales help. If the merchandise you handle is so advertised, you can "go out in the country" with the assurance of a favorable reception.

The Radios Farm Folks Buy

The radios that are known and used in the Northwest are advertised in **THE FARMER**. Thousands of dollars' worth of advertising has been rejected as unsatisfactory, practically all of it mail order. That benefits you! Sell **FARMER**-advertised lines if you want the least sales resistance in the Northwest.

THE FARMER carried more radio advertising in the first six months of 1926 than any other farm paper in the whole country. In the Northwest it led on radio advertising by a tremendous margin. Read **THE FARMER** and keep posted on the sales work being done for your benefit by aggressive manufacturers.

Do This!

*If you do not get
The Farmer send for
free sample copies.
Tell us what radios you
sell and we will send
you their advertise-
ments.*

THE FARMER
Webb Publishing Co., Saint Paul, Minnesota
The Northwest's Only Weekly Farm Paper

A Northwestern Institution Since 1882

Member Standard Farm Paper Unit


FIFTH ANNUAL NORTHWEST RADIO SHOW

*1926 Official Log
Year Book*

Program and Directory

—*Issued By*—

Northwest Radio Trade Association



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THE FIFTH ANNUAL Northwest Radio Show

WE ARE LIVING IN A RADIO AGE. RADIO IS THE GREATEST DISCOVERY OF ALL TIME. AND ITS POSSIBILITIES ARE STILL UNLIMITED.

OF GREATEST INTEREST, THEREFORE, TO THE PUBLIC, AND TO THE TRADE AS WELL, IS THE ANNUAL RADIO SHOW OF THE NORTHWEST RADIO TRADE ASSOCIATION. FOR HERE WE AIM TO SHOW EACH YEAR THE ADVANCEMENT OF THE ART, THE DEVELOPMENTS OF THE YEAR AND THE NEW ADAPTATIONS OF RADIO TO THE NEEDS OF THE HUMAN RACE.

THE FUNDAMENTAL PRINCIPLES OF RADIO HAVE NOT CHANGED SINCE THEIR DISCOVERY MANY YEARS AGO. WE HAVE SIMPLY FOUND MORE EFFICIENT WAYS CONTINUALLY OF USING THESE PRINCIPLES. A GREAT MANY OF THE WELL-MANUFACTURED SETS THAT WERE MADE FOUR AND FIVE YEARS AGO ARE STILL GIVING AS GOOD SERVICE AS THEY WERE AT FIRST. THERE IS NO PARTICULAR WEAR-OUT TO A SET AS THERE ARE VERY FEW MOVING PARTS. THE ADVANCES YEAR BY YEAR ARE MAINLY REFINEMENTS IN WORKMANSHIP AND APPEARANCE, IN EFFICIENCY AND EASE OF OPERATION. NO ONE NEED HESITATE ANY LONGER IN THE BUYING OF A RADIO SET, THINKING THAT NEXT YEAR SOMETHING BETTER WILL BE BROUGHT OUT. THIS YEAR'S SETS WILL DELIVER THE GOODS AND WILL GIVE YOU MANY YEARS OF SATISFACTORY OPERATION.

A RADIO SET IS BECOMING OF MORE VALUE AND IMPORTANCE IN THE MODERN AMERICAN HOME TODAY THAN ANY OTHER EQUIPMENT IN THE HOME. WE BELIEVE THAT BECAUSE OF THE RADIO BEING A MEANS OF MASS COMMUNICATION MORE HOMES IN AMERICA WILL HAVE RADIO INSTALLED WITHIN A SHORT TIME THAN ANY OTHER ONE ARTICLE IN THE HOME. IN OTHER WORDS, THAT THERE WILL BE A GREATER PERCENTAGE OF SATURATION THAN ON ANY OTHER MODERN INVENTION.

IT BEHOOVES US ALL, THEREFORE, TO BECOME AS WELL INFORMED ON THIS NEW SCIENCE AS WE CAN BE AND IT IS FOR THAT PURPOSE THAT WE PRESENT HERewith A BOOK OF AUTHENTIC INFORMATION ON ALL PHASES OF RADIO IN THE HOME. THE AUTHORS OF THE VARIOUS ARTICLES ARE AMONG THE BEST AUTHORITIES IN THE COUNTRY ON THE SUBJECTS THEY HAVE CHOSEN. TAKE THIS BOOK HOME WITH YOU AND KEEP IT NEAR YOUR RADIO SET.

NORTHWEST RADIO TRADE ASSOCIATION.

The Theory of Radio

WHAT IT REALLY IS AND HOW IT HAPPENS
THAT YOU CAN SIT IN YOUR HOME
AND HEAR A SINGER MILES AWAY

By C. M. JANSKY, JR.
University of Minnesota

THE RELATION OF RADIO TO OTHER FORCES

To most individuals, the transmission and reception of speech and music by radio is a very mysterious process, yet in many ways it is similar to phenomena with which we are quite familiar. Scientists have known for a number of years that radio waves are identical in nature with the waves we call "light." Scientists have known for many years that light is a wave motion which travels with a velocity of 186,000 miles per second. For each particular color of light there is associated a particular wave length, that is, distance from crest to crest. The wave length of violet light is approximately 4 one-millionths of a meter, while the wave length of red light at the other end of the spectrum is approximately 8 one-millionths of a meter. All of the waves which produce in the eye the sensation of light have wave lengths which range between 4 and 8 one-millionths of a meter.

Radio waves are identical in nature with light waves, except for the fact that wave lengths used for radio communication are much longer than light waves. Radio stations of all sorts today are using wave lengths which range from 5 meters to 24,000 meters. Broadcasting stations in the United States are today using those wave lengths between 200 meters and 545 meters.

HOW RADIO WAVES ARE PRODUCED AND MEASURED

Radio waves are produced by high frequency alternating currents. With each particular frequency there is associated a particular wave length. Thus a frequency of 1,500,000 cycles would produce a wave length of 200 meters, or a frequency of 500,000 cycles would produce a wave length of 600 meters. Contrast these frequencies with the frequency of ordinary house lighting current, which is 60 cycles per second.

The Gold Medal Radio Station transmitting apparatus produces electric current at a frequency of 720,000 cycles. This current is carried to the familiar antenna and ground

system which you can see at the transmitting station. Because the frequency used is 720,000 cycles, the antenna system radiates a wave length of 416.4 meters. If you know the frequency produced in an antenna you can calculate the wave length radiated in meters; or if you know the wave length, you can calculate the frequency which produces that wave length. The method is as follows: The wave length radiated in meters is approximately equal to 300,000,000 divided by the frequency in cycles per second, or the frequency in cycles per second is equal to 300,000,000 divided by the wave length in meters.

VELOCITY OF RADIO WAVES

Signals from a radio broadcasting station travel with a velocity of 186,000 miles per second, and are radiated in all directions. Transmission is therefore practically instantaneous. These signals may be picked up at any location within the range of the station by anyone who installs the necessary receiving equipment.

VARIABLE RECEPTION—STATIC—FADING

Conditions which effect transmission and reception of radio waves vary greatly from season to season, day to day and even hour to hour. In general, transmission is better at night than in the daytime, although in some localities under certain conditions better receiving conditions exist in the daytime. Various conditions affect reception of signals. Atmospheric disturbances or static may be of such intensity that reception is unsatisfactory on a particular night, while the next night no atmospheric disturbances of any sort may exist and signals may be received over great distances. Signals from a particular station may be found to vary greatly in intensity, a signal being very loud at one instant and inaudible the next. This phenomenon is called "fading." While we know a great deal about the nature of fading, we do not know its exact cause. When a signal fades it is useless to attempt to bring it back by retuning, the only thing to do is to wait until the signal comes back again of its own accord.

The operation of many electrical devices used by modern civilized man produce small local disturbances which may interfere with radio reception. Disturbances such as these are called "inductive radio interference." Thus we might classify the various obstacles to reception under the three heads given above, fading, static and inductive interference.

TRANSFORMING MUSIC TO RADIO WAVES

In order that we may better understand the engineering problems involved in the delivery of high-grade broadcast service, let us follow a program from the studio in its travels to the listener. For the purpose of illustration, suppose we consider a program originating in a studio in New York City as broadcast from the Gold Medal Station WCCO at a time when this station is acting as a part of the broadcast chain so familiar to all. The speech and music originating in this studio consist of sound waves carried by the air. These sound waves are of frequencies ranging from 50 to 5,000 cycles per second. The character and nature of the speech and music determines what frequencies are to be present and what will be their relative amplitudes. Sound waves in the studio strike upon a carbon microphone, which converts the sound energy to electrical energy. The electrical frequencies produced by the microphone must correspond exactly in nature with the sound frequencies. After the electrical currents have been amplified they are transmitted to the Gold Medal Station over more than a thousand miles of wire lines. On this thousand-mile trip the electric current must be amplified time and time again, otherwise it would completely die out. At the Gold Medal Station transmitter the electric currents which represent the programs in New York are used to modulate the output of the high frequency generating system which is generating 720,000 cycles, and which, as we have seen, is radiating a wave length of 416.4 meters.

The amount of power produced in the microphone circuit in New York is only a few millionths of a watt. The amount of the power radiated by the transmitter of the Gold Medal Station is 5,000 watts, yet this few millionths of a watt which has been carried over a thousand miles of wire line must be used to vary the output of the transmitter which is radiating 5,000 watts, and if no distortion is to exist, this variation in amplitude of the 5,000-watt transmitter must represent exactly the character of the sound which strikes the microphone.

Energy from the transmitter is radiated in all directions. At a receiving set this radiated energy is collected, amplified and converted to electric currents, which, when run through a reproducer or loud speaker, produce speech and music. In order that no distortion shall exist, and in order that the program shall be worth listening to, it is absolutely essential that every piece of apparatus from the microphone to the loud speaker shall perform satisfactorily, an engineering problem of no small magnitude.

We have seen that a radio broadcasting station is primarily a system for the simultaneous dissemination of information and entertainment in all directions. A little consideration of such a system of communication will show that it is admirably adapted to serving the need of a territory such as this. Broadcast service, while it is of great interest to those who live in large cities, can be of greatest economical and social service to those residing in the country and in small towns. The development of the automobile and the good roads, which have come with this development has made it possible for the rural dweller to have some of the advantages of the city. Radio broadcasting can and will carry some of the advantages of the city to him.

Mr. Jansky is the head of radio instruction at the University of Minnesota. He is also consulting engineer of the Gold Medal Station WCCO, a director in the National Association of Broadcasters and Director of the Dakota Division of the American Radio Relay League. He has been a member of all the Hoover radio conferences and is regarded as one of the highest radio authorities in the country.

Various Types of Sets

BY DON C. WALLACE
PEERLESS ELECTRICAL COMPANY,
MINNEAPOLIS

Receiving sets are probably of far more interest to us than broadcasting stations, as it is receiving sets that we have to buy and keep in operation in order to get the great use and enjoyment out of radio that it is possible to have.

Marconi first accomplished successful transmission of radio in the year 1898, but it was not until 1912, when the vacuum tube was invented, together with the developments in Armstrong's regenerative circuits and the discovery of the value of radio frequency circuits, that the world began making any practical use of radio. The World War caused the development of the science to be far more rapid, both in this country and abroad, than it would otherwise have been. The government had numerous engineers at work on radio inventions and research in order to make the best possible use of them for defensive and offensive purposes. Two or three broadcasting stations were started by the big electrical companies in order to test out the possibilities of sending out voice and music over long distances. Their first listeners were the amateur code operators.

THE FIRST RECEIVING SETS

The amateur set of that time was what we term today a three-circuit tuner. The nature of this circuit will be discussed later. Practically nine out of ten radio receiving sets in existence at that time were three-circuit tuners and, of course, satisfactory results were secured from the start. From then on, developments in transmitting and receiving sets were made very rapidly. Receiving sets became more compact, neater, easier to handle and more nearly perfect mechanically.

The large number of broadcasting stations which immediately came on the air made room for the crystal set, which had practically become obsolete during the years following the development of the vacuum tube. It was found, about that time, that the crystal set proved very satisfactory as a source of entertainment and could produce music and entertainment in the homes of people in the vicinity of a large broadcasting station with comparatively little expense. It would receive stations satisfactorily up to a distance of twenty-five miles. The crystal set has

once again become a thing of the past, because of the difficulty in segregating the different stations in each locality and the inability to amplify the signals for loud speaker reproduction without employing tubes. They were very good and quite satisfactory when one or two moderately powered broadcasting stations existed in each community, but when eight or ten or even thirty stations came on the air, the crystal set was found inefficient as no amount of tuning could correct this difficulty.

THE CIRCUIT IN A RECEIVING SET

Because the single circuit crystal receiving set is the simplest form of circuit known, we will here give an explanation of what happens in the circuit of a set:

The electro magnetic waves emanating in all directions from the broadcasting stations are intercepted by the antenna wire attached to your crystal receiving set. The induced current set up in the antenna circuit passes from the lead-in wire into the antenna coil of the set and thence to the ground.

The various circuits within our sets, however, are a different thing and are used to bring about the rectification and amplification of electrical impulses into voice and music.

In the single circuit crystal set, the following action takes place: The signal first passes through the antenna coil as previously described, one end of this coil being connected to the antenna and the other to the ground. A second and larger coil placed in the plane of the antenna coil and close to it, has induced in it a voltage of the same frequency as that passing through the antenna coil. This larger coil is the means by which undesirable signals are eliminated and an individual signal chosen at will. This tuning, as it is called, is accomplished by taking taps off at various turns or by placing a variable condenser across the coil. One terminal of this tuned circuit is connected through the crystal to the receivers. The other goes direct to the other terminal of the receivers or head-sets.

The crystal is usually a flat piece of galena or silicon that allows current to pass through it in one direction only. This action is called rectification and converts the high fre-

quency impulses from the broadcasting station into low frequency pulsating direct current which, when passing through the head phones, makes the audible signal. Literally, the crystal changes the signals sent out from the station from pulsating electric signals to uni-directional signals, which can be heard in the head phones. The coil, condenser, crystal and head phones are all hooked in series so that the circuit is closed and completed. The coil alone is variable to adjust it to the proper wave length of the broadcasting station desired.

ADDITIONAL CIRCUITS AND MORE APPARATUS

The single-circuit crystal set corresponds to the one-cylinder automobile. If you want more power and speed you have to have more cylinders and better equipment. So it is with a radio set. Nowadays the vacuum tube has replaced the crystal in view of the fact that it not only rectifies but it may be made to amplify at the same time. In other words, it performs the same function but gives added signal strength on a signal of the same intensity. More coils, condensers, tubes, rheostats, potentiometers, etc., are added to make other essential circuits within the set, but the fundamental principle is just the same. Thus the adaptations are known as one, two, three and four-circuit sets. They are also spoken of as being Regenerative, Non-regenerative, Reflex, Inverse-Duplex, Neutrodyne, Radio Frequency and Super-Heterodyne.

In 1920 the number of broadcasting stations had grown to the extent that the public became interested in hearing the programs and the gigantic radio industry as it is known today was founded.

REGENERATIVE CIRCUITS

Major Edwin Armstrong discovered the principle of regeneration whereby any vacuum tube circuit could feed a part of the output of the vacuum tube back into the input circuit and in this manner increase the volume to the utmost. It was a sort of loop the loop process. It was very efficient and as long as there were only a few listeners in the community it was all right. The difficulty with regeneration, however, was that when improperly handled, the regenerative set radiated or, in other words, sets up a disturbance in the ether similar to a signal broadcast from a regular broadcasting station. This interference is sometimes evident over a distance of several miles, and is extremely discouraging for the person operating a receiving set near such a

tuner. These radiating sets were quite bothersome to the situation as a whole and numerous campaigns have been started to do away with them. They are variously referred to as "Bloopers," "Squealers," etc. A single-circuit regenerative set can be operated so that it does not radiate, by keeping regeneration just below the peak or the point of oscillation. The trouble is that owners of this kind of sets try to crowd the tube too far in order to get just a little more volume, and the tubes break into oscillation and radiate. Very few manufacturers are now making the simple single-circuit regenerative set and the situation is growing better.

RADIO FREQUENCY STAGES ADDED

The problem of radiating sets was overcome by inserting ahead of the detector tube, which did the radiating, from one to three amplifying tubes, which amplified the radio signals before they were rectified into uni-directional signals referred to above. These addition tubes are called One, Two or Three Stages of Radio Frequency Amplification as distinguished from the One, Two or Three Stages of Audio-Frequency Amplification, which follow the detector tube in the circuit. When the detector tube was directly connected to the antennae circuit in the regenerative set, it radiated, but when the radio frequency tubes were in the circuit, the detector tube could not radiate a wave back through the radio frequency tubes to the antenna.

The average five-tube set today consists of two stages of radio frequency amplification, one detector tube and two stages of audio frequency amplification.

ONE, TWO AND THREE-CIRCUIT ACTION EXPLAINED

The terms single-circuit, two-circuit or three-circuit must not be confused with one, two or three-dial control. The general idea of the circuits is to indicate the parts of the circuit that are tuned to the incoming wave.

The single circuit tuner is usually one in which the grid circuit is either tuned by tapping the coil or by a condenser connected directly across it a regeneration control by a tickler or adjustable coil revolving in the field of the grid coil.

A two-circuit tuner is a term more often applied to a set having a tuned antenna circuit and a tuned grid circuit with a variometer for controlled regeneration.

The three-circuit tuner consists of a tapped antenna coil, a grid circuit, accomplished by a variometer or shunt condenser and a variometer in the plate circuit.

ONE DIAL CONTROL

In the modern sets, one dial may be made to control as many as three or four circuits by gearing their controls all on to one shaft and having the selectivity of the four separate circuits. In this case, however, manufacturers are required to use additional skill in designing and producing the machine. Extremely selective and sensitive units are on the market at this time, employing one control for all ordinary tuning. A device is usually provided for adapting the instrument to various types of antennae. The performance of the set as a whole rather than the number of dials, will always be the final test. The elimination of a number of controls on a set is an effort to improve the appearance and ease of operation.

REFLEX AND INVERSE-DUPLEX CIRCUITS

The term "reflex" as applied to sets simply indicates that the set uses one or more tubes twice. In the ordinary set a tube is put in a certain circuit and does a certain duty there. In a reflexed set, it is made to do double duty.

The Inverse-Duplex is simply the establishment of a reverse order of reflexing as compared to the methods used originally. For instance, the five-tube set has two stages of radio frequency, one detector and two audio frequency. If this were a reflex set, one of the audio frequency circuits would be superimposed upon one of the radio frequency circuits so that only four tubes would actually be in the set, but one of them would be doing double duty. In the inverse-duplex, two stages of audio frequency are made to pass through two stages of radio frequency in reverse order or backwards, thus keeping all tubes loaded equally at a maximum and needing only three tubes.

THE NEUTRODYNE CIRCUIT

The Neutrodyne is a form of radio frequency set employing a condenser between the grid and one of the tuning coils in order to prevent the oscillations which are set up in a sensitive radio frequency circuit when the resonance point is reached.

THE SUPER-HETERODYNE

The Super-Heterodyne is a form of circuit which permits the radio frequency amplification to be carried on at its most efficient point. In a certain eight-tube super, the stages run as follows: One radio frequency tube, one oscillator, first detector and then three stages of intermediate frequency, all of these stages having to do with the radio frequency amplification. The seventh tube is the real detector and the eighth is a stage of audio frequency amplification.

IN GENERAL

Sometimes there are different combinations of the above sets. Generally speaking, the sensitiveness depends upon the way in which they are put together and upon the type of circuit used. This same thing applies to the number of tubes used in the set and the number of dials and controls. Greater efficiency is being accomplished continually by all manufacturers of sets. The buyer of the set, therefore, will do well to inquire as to the maker of the set, his reputation, and listen to the performance of the set rather than buy it for its number of tubes or the particular circuit employed.

RECEPTION THAT MAY BE EXPECTED

Reception from sets is in a large measure determined by the broadcasting. If good broadcasting is in the air, then a receiving set is far more useful. If broadcasting in the air is not so good then reception is not so good. The reception of good programs from nearby stations will be found to be far more pleasing and profitable than straining your ears to catch the indistinct signals of some far distant station. If your set receives stations clearly and distinctly up to a thousand miles away, you will be able to get the best programs obtainable. The fever to get Europe and South America has died out quite rapidly within the past year.

Mr. Wallace—pioneer in the radio business in the Northwest, was in the game as an amateur years before the commercial advent of radio—has seen all makes and kinds of sets. Mr. Wallace won the Hoover Radio Cup in 1923 as the best amateur operator in the country. He is chairman of the board of directors of the Northwest Radio Trade Association.

RADIO CORPORATION OF AMERICA



Radiolas Radiola Speakers Radiotrons



Distributors to the Northwest
By

R. M. Laird Electric Co., Minneapolis
Booth No. 30

Peerless Electrical Co., Minneapolis
Booth No. 11

Northwestern Electric Equipment Co., St. Paul
Booths No. 2 and 3

St. Paul Electric Co., St. Paul
Booth No. 13

Installing Your Set and Keeping It Working

BY C. C. SCHWEISO

The growth of the field of Radiophone Broadcasting and the development of apparatus pertaining thereto has been, to say the least, spectacular. In its present state it is unquestionably stable and the many who are availing themselves of its unlimited benefits will be using the machines they buy this year for many years to come. Perhaps, at certain stages in the development of the art, there were times when the layman was justified in remarking, "I am going to wait until next season and look over the new machines," but such cases are no longer founded upon good judgment. This is one of the greatest years in the history of Radiophone Broadcasting and thousands of new listeners will be on the air this fall to enjoy the full benefits of this great entertaining and instructional medium with its unlimited dimensions.

Inasmuch as the fundamentals of installation, operation and maintenance have become practically standardized it is possible to summarize them for the ready reference of all owners, and prospective owners, of radiophone receiving set installations. The purpose of this chapter is, therefore, to outline some of the most important factors upon which depends the operating efficiency of any standard installation and which, in consequence, should be understood generally if satisfaction is to be secured. It is hoped that it will not only assist those who will install sets in their homes in the future but also enable present owners to increase the overall efficiency of their present system.

ANTENNAE CONSTRUCTION

The first problem that usually confronts the prospective set owner is that of an antenna so it is but logical to assume that we should start our discussion at that point. There are three distinct types of antennae in common use today; the most common being the outdoor type; the second, and the one of growing prominence, the simple indoor type, and the third commonly known as loop or coil antenna. At this point too much stress cannot be placed upon the importance of following implicitly the instruction sheet furnished with all factory built machines. Such sheets always specify the type of anten-

na to which the set is adapted but do not always give instructions on its construction. Most loop receivers are supplied with the antenna built in or as a separate unit so no further comment is necessary on this type other than that external loops, or machines having loops built in, should be kept out of close proximity or exposed or unshielded electric wiring, large metal bodies, or electrical apparatus that might cause interference. Leads from external coil antennae should be as short as possible or the directional effect of the antenna may be affected.

Most receivers adapted to outdoor antennae will allow a certain amount of originality in antenna design. A good general rule to follow is that the antenna be sixty to seventy feet long, not including leadin, and from twenty to thirty-five feet high. For all practical purposes the single wire type is preferable. The wire should be either single or stranded enameled copper, or other metal of high conductivity, and well insulated from the supports at either end. It is advisable to use good insulators with at least two in series at each end particularly where metal poles are employed. The energy received by the antenna is infinitesimal and a coating of moisture on a single insulator might ground enough of it to appreciably affect the signal strength under such conditions. Antenna and leadin should be kept clear of all objects such as trees, roofs, telephone and power wires, and should, if possible, be a continuous wire. Where rubber insulated leadin wire is used the splice to the antenna proper should be soldered and well coated with Valspar varnish, not taped. Briefly stated, the distance over which a set will work satisfactorily, and the volume of the receiving signal, will vary directly with the length and height of the antenna. Selectivity, however, may be decreased if the antenna is too long. Of course, there are limits within which we must abide and the figures given are a good average where definite specifications are not given. The leadin should be taken from the extreme end of the antenna proper and the enclosed angle between antenna and leadin should not be less than ninety degrees. This accounts for the fact that most antennae of the inverted L type are constructed with the distant end higher

than the one to which the leadin is attached. It might be of interest to know that an antenna of this type has directional tendencies which favor stations located in the general direction of the end from which the leadin is taken. This is not a deciding factor except where it is desirable to erect the antenna for listening to some specific station where surroundings are not as confining as in most urban localities.

Indoor antennae are coming into more prominence due to the fact that exposed loops are unsightly inside a home and outside antennae are often difficult to erect in congested areas. Many set manufacturers are enclosing loops and sets in common cabinets while others recommend the use of short indoor antennae placed behind picture mouldings or out of sight in the attic. Both have their advantages and have attained a remarkable degree of efficiency. As in the outdoor type, originality is required in many cases to cope with the specific circumstances involved. In all cases they should be well insulated and kept clear of metallic obstructions. Stranded loop antenna wire, Litz, or even ordinary fixture wire may be used if it is desired to place it behind picture mouldings or beneath rugs. The best method is to run the wire in some general direction, without doubling back, and isolate the far end as far as possible from the set. Inside antennae and loops may not give the desired results in steel frame buildings or dwellings in which metal lath has been used. In this case loop sets, or principally the loop itself, should be moved away from any prominent steel member and placed near an outside window. If the set calls for an indoor antenna it is recommended that a small outside wire be erected along the same plans as the usual outdoor type. It need not, however, be as long or as high as the general case outlined in the preceding paragraphs. Fortunately, even where metal lath is used, there is usually a dead space near the roof where an inside antenna may be swung for the roof itself is seldom metal.

GROUND CONNECTIONS

Inasmuch as antenna and ground systems are usually spoken of as one unit, a few remarks on the latter may be considered proper. Grounds should be the best you are able to make. A ground to a cold water pipe is preferred to one made to any other piping in the average home. A copper plate or screen sunk in a cistern, well or creek bed makes an excellent ground where such is available. Surfaces should be polished and the connection made in the best manner possible.

Anyone contemplating the erection of an outdoor antenna should consult their dealer on the matter of Fire Underwriter's Rules governing the size of leadin and ground wires, lightning arresters and protective grounds. Some cities also place additional restrictions on outside wires.

The leadin, whether from an outside or inside antenna, should run directly to the set and be properly insulated at any point where it would come into contact with the wall or other foreign obstacle. This, of course, is one of the determining factors in the proper placing of the set. Furthermore, the leadin, and antenna too, should be taught to prevent swaying, and the former, in the case of outside installations, should be kept free from the building above its point of entry. Both leadin and ground wires should be scraped clean and tightly attached at their proper binding posts.

CHECKING UP YOUR SET INSTALLATION

After making sure that all batteries have been properly connected, the tubes may be inserted in the sockets, the reproducer attached and the set placed in operation according to the manufacturer's instructions. If, when these preliminary matters have been looked to, you do not get results, recheck your installation before calling in the dealer from whom you purchased the set. In nine cases out of ten the trouble lies at some point that has been overlooked in the original setup. Do not make the mistake of dissecting the set or calling in some self-dubbed radio engineer who professes to know more about the set than the manufacturer who produced it. It will be found that a headset will assist materially in mastering the fundamentals of tuning as it accentuates sounds more than the average reproducer and enables one to learn the characteristics of all inherent noises. After a short time it will become quite easy to select many of the larger stations using the reproducer in place of the headset and as the senses become more acute the list of stations will enlarge proportionately. A headset is always a handy device for getting the last ounce of work out of the set on an extremely weak signal or for checking the set in case of trouble where it is not desirable to disturb other occupants of the room.

CARE AND OPERATION OF TUBES

In considering the matter of proper operation there are a few very important don'ts that are worth mentioning. Do not crowd the set by working the filaments of the

tubes above the point on the rheostat scale marked by the manufacturer. This will not only destroy the tone quality but shorten the life of the tubes materially. If your set has a volume control that will, when advanced too far, cause the set to howl and squeal, keep that volume control at all times below the critical point. Practice will enable you to advance it to the sensible limit without oscillation and the program will be more enjoyable to your own group and to the set owners in your immediate neighborhood.

RADIO RECEIVING SET A DELICATE INSTRUMENT

A receiving set today has become a musical instrument of much the same nature as a phonograph and the primary consideration has been one of tone rather than enormous volume. If more volume is desired see your dealer before overloading your tubes with your B Power Supply Units or excess B battery voltage, thus destroying tone quality, tubes and reproducer unit. When weather conditions render reception difficult give the set and its accessories the same consideration you would give your automobile if it were resting in eighteen inches of loose gravel. With proper care in operation and a reasonable knowledge of the fundamentals of maintenance a radiophone receiving set may be made to give its owner an inestimable amount of pleasure the year around.

UPKEEP OF THE SET

Assuming that the installation has been made and the set has performed its function properly over a reasonable period of time we may expect that it will require some attention as does anything else in life. Tubes will become inactive after a long period of use, batteries will run down, and even the antenna may suffer from a long winter outdoors. Such are the things we should learn to care for if we are to enjoy the utmost satisfaction from our receiving set. It is a good idea, therefore, to occasionally check these various units and not wait until the entire installation goes to pieces through lack of attention. The old adage, "an ounce of prevention is worth a pound of cure," applies in its truest sense to a receiving set and its supplementary equipment. To explain in detail the methods of going about such a matter on each of the various characteristic types of set installations would be a lengthy and difficult task but these details may be somewhat generalized for the sake of brevity.

If reasonable attention is given to maintenance of equipment a receiving set seldom goes "dead" instantly. A warning usually presents itself in one of many ways depending upon the type of set and accessories. The signal strength may fall off gradually or the set become unstable and hard to handle. The tone quality may become fuzzy and lose its character, the tuning may become broad, or in the extreme case the set may refuse to function at all or cease to function in the midst of a program.

The antenna and ground systems should be inspected at least once a year and if the antenna itself is badly discolored from corrosion it should be replaced. All connections in this system should be brightened and replaced. Lightning arresters should be examined for short circuits or leaks due to accumulation of particles of soot and dirt. If these things have been properly cared for and any of the aforementioned symptoms show themselves you may rest assured that the trouble is within the balance of the apparatus.

If you are using a B Power Unit the chances are pretty good that the difficulty is not lack of proper voltage from that source so the storage battery or its equivalent should be the next consideration. If increasing the setting of the rheostat results in a slight increase in signal strength one may be even more certain that the difficulty rests in the "A," or filament, circuit.

CHECKING OVER A DEAD SET

If both "A" and "B" batteries or their substitutes are in proper condition attention should be directed to the tubes. The "C" battery should be replaced once a year for only in rare cases will down short of that time. In cases where the set goes dead suddenly the tubes should be the first to receive attention after the battery switch has been placed on the off position and all appurtenances connected to the electric light circuit disconnected therefrom. All tubes should then be removed from their sockets and arranged upon the table in the order in which they were used in the set. The batteries and other current supply devices may then be reconnected to the set and in doing so the operator should note any excessive sparking when contacts are made. Such excessive sparking would indicate that some connection has become loosened resulting in a short circuit or that some one of the instruments within the set is defective. Do not mistake the condenser discharge that always accompanies the opening of a B battery circuit as exces-

sive. If nothing out of the ordinary is discovered when connecting these devices back into the circuit set the rheostat at minimum and place one tube after another into one of the sockets (preferably one to which the filament voltage is varied by the rheostat for in many cases automatic devices are used on audio frequency amplifiers and other non-critical tubes) and turn on the filament switch. If the tube does not light at all, or lights to abnormal brilliancy, it may be assumed to be defective and should be tested before replacing in the set permanently. It is a very sensible precaution to have one or two extra tubes on hand to meet emergencies. In fact, all tubes should be taken to your dealer for a semi-annual check up. For a slight charge he will mark the tubes according to their respective merits which will enable you to approximate the life remaining in them. If all tubes light normally in this test we have progressed as far as possible without the aid of a tube tester. We know that our antenna and ground are in good shape and properly connected to the set. We have tested all batteries and examined their connections to make sure that everything is intact. We assume that the B Power Unit is working, this being necessary in view of the laboratory instruments required to test it, and all tubes light to a normal degree of brilliancy. The next move is to call your dealer and ask for his serviceman's assistance. Here again let me caution against the self-dubbed engineer. Because your watch runs slow you do not trust it to your neighbor's ingenuity simply because he says he knows all about it. Most radio sets are far more expensive than watches and, in the hands of a novice technician, equally as liable to ruin.

As stated, we assumed that the B Power Supply Unit was operating but your dealer's serviceman will examine it and make certain for sometimes even such devices will

need attention. He will also repair the set if necessary and the entire expense will be far less than it would have been had an inexperienced person attempted to remove the trouble. Cases are rare where the set itself is found to be defective, whence, the procedure outlined will invariably bring the difficulty to light and enable the owner to make his own adjustments at the bare cost of battery or tube renewal.

KEEPING UP YOUR SET WORTH THE EFFORT

If the material contained in this, and other articles in this booklet, is studied conscientiously and sensibly applied the enjoyment received from your radiophone receiving set will be greatly enhanced. A good receiving installation, a working knowledge of its care and operation to insure constant efficiency, and one has a world of enjoyment at his finger tips. Build up an authentic log of all stations received and keep it up-to-date for reference so that when your favorite artist is unexpectedly announced in the evening paper you can immediately get the desired station. An up-to-the-minute log is to your receiving set what an unlimited library of records would be to your phonograph. Another matter which should not be overlooked is the fact that, after all, if it were not for the broadcasting stations and the artists who supply them with the material to broadcast, all of our modern receiving equipment would be of no avail so we should take it upon ourselves to express our appreciation of their efforts. Brief communications now and then to various stations, complimenting them on their programs, suggestions, and a sign of interest in the station's activities will do a great deal toward continuing this great medium of the age.

Mr. Schweiso represents the Bremer-Tully Manufacturing Co., one of the foremost manufacturers of radio equipment. Mr. Schweiso is also Chairman of the Educational Committee of the Northwest Radio Trade Association, who are sponsoring a course at Dunwoody Industrial Institute, Minneapolis, for the training of radio service men. He is well qualified to advise users how to properly install their sets and keep them working.

Dry Batteries

BY GEORGE H. RIEBETH
FRENCH BATTERY CO.

The acid or moisture necessary to secure the full amount of electrical energy from a dry cell battery is placed in the battery before it is sealed. Should these batteries be placed near a radiator, battery charger or a very dry or hot place and cause evaporation of the moisture in the cells, the battery will not render full service. Each individual dry cell, regardless of size, is rated at $1\frac{1}{2}$ volts.

There are three types of dry cell batteries made for radio service:

DIFFERENT TYPES OF DRY BATTERIES

A BATTERY: The purpose of the "A" battery in the radio set is to heat the filament in the tube to the point where it will expel sufficient electrons to permit the "B" battery to function. It has no other purpose. Dry cell "A" batteries used with tubes made for that purpose, are a great convenience and comparatively economical where electrical current is not available for charging storage batteries.

B BATTERY: The "B" battery furnishes the electrical energy which actuates the loud speaker or phones of the radio set. Without the "B" battery the radio set would be dumb. Through the wonderfully delicate control of the grid element of the tube on the electron flow from filament to plate, the "B" battery energy is released in modulated trains corresponding exactly to the sounds introduced into the transmitter at the broadcasting station. The amount of "B" battery current used is partially determined by the amount of voltage used on the filament of tubes. Excessive filament heat will cause excessive demand on the "B" batteries. The dry cell type of "B" battery is commonly used because voltage is the big factor and it is more economical and convenient to assemble the number of cells necessary to furnish the required voltage with this type of battery.

C BATTERY: The "C" battery puts a negative charge on the grid of the tube, thereby forcing it to operate with more clarity and less distortion, at high "B" battery voltages. The negative voltage imposed on the grid also reduces the amount of current taken from the "B" battery to approximately one-half the amount which would otherwise be taken out.

INFORMATION RELATIVE TO "B" BATTERY SERVICE

Approximate service to be secured from a

standard size "B" battery, 45 volt, retailing at from \$3.75 to \$4.00, when used WITHOUT A "C" BATTERY, and operating a set with five No. 201-A tubes:

67½ Volts	200 hours
90 Volts	120 hours
135 Volts	60 hours

Approximate service to be secured from a standard size, 45 volt "B" battery, when used WITH A "C" BATTERY, operating a set with five No. 201-A tubes:

67½ Volts	425 hours
90 Volts	350 hours
135 Volts	280 hours

An extra large "B" battery, 45 volt, retailing at \$4.75 to \$5.50 will give about 80% more service than the standard size battery. The average five tube set operated with 90 volts of "B" battery, and WITHOUT A "C" BATTERY, requires from 24 to 34 milliamperes "B" battery service.

A standard size "B" battery delivering 15 milliamperes per hour of service will render a total service of about 235 hours. An extra large "B" battery delivering 15 milliamperes per hour of service will render about 430 hours of service. A standard size "B" battery should not be used on a set requiring more than a 15 milliamperes service.

Some of the better known radio sets using 90 volts of "B" batteries have, within the last year, reduced the "B" battery current demand from 25% to $33\frac{1}{3}\%$, without reducing the volume and efficiency of the set. There will be further developments along this line to improve "B" battery service. An extra large "B" battery will operate a set drawing 10 milliamperes, about 700 hours. A receiving set made to operate on 90 volts of "B" battery should work efficiently on those batteries until batteries have reached a voltage of from 65 to 68. Receiving sets using a small amount of "B" battery current will operate at a correspondingly lower voltage.

SOME THINGS YOU SHOULD KNOW ABOUT "B" BATTERIES

All "B" battery connections should be firm to give good service. If connections are not firm a set may be noisy.

If the connections between individual cells, that make a "B" battery, are not firmly soldered, a "sneak leak" may develop and cause a noisy battery. Great care should be exercised in connecting "B" batteries together and with the receiving sets. If the wrong































connection is made and the battery is short circuited for a period of ONE MINUTE, the "B" battery will discharge during that ONE MINUTE the amount of current that would service the average set for ten hours.

The condition of the tubes have a great deal to do with the cost of "B" battery service. Dry cell tubes UV-199 and C-299 are made to operate most efficiently at 3 volts. The initial voltage of a dry cell "A" battery to service these tubes is $4\frac{1}{2}$ volts. The rheostat is used to regulate the voltage. Should the tubes be operated at the full $4\frac{1}{2}$ volts they will lose their efficiency within a short time, and in addition, an excessive amount of "B" battery current will be used. A 201-A tube is made to operate most efficiently at 5 volts; should much heavier voltage be used for some time the tubes will lose their efficiency and at the same time an excessive amount of "B" battery current will be used.

The radio set should have a voltmeter to show the amount of "A" battery current being used on the tubes to guard against paralyzing the tubes with excessive voltage. A uniform voltage of "B" batteries is essential for good radio reception.

Standard makes of batteries, distributed by reliable jobbers and dealers, which are scientifically made, will produce better radio reception at a lower cost.

RADIO SYMBOLS

 AERIAL	 CONDENSER (FIXED)	 RECEIVER TELEPHONE
 AERIAL (LOOP)	 CONDENSER (VARIABLE)	 RESISTANCE (VARIABLE) FILAMENT RHEOSTAT
 AMMETER	 CONNECTION	 RESISTANCE
 BATTERY "A"	 DETECTOR (CRYSTAL)	 SWITCH
 BATTERY "B"	 GROUND	 TRANSFORMER (AUDIO FREQUENCY)
 CHOKE COIL	 GRID LEAK	 TRANSFORMER (RADIO FREQUENCY)
 COIL	 JACK	 VOLTMETER
 COIL (HONEYCOMB)	 LOOSE COUPLER COUPLED COILS WITH VARIABLE COUPLING	 VACUUM TUBE
 COIL (SPIDERWEB)	 NO CONNECTION	 VARIOMETER
 COIL (TUNING)	 POTENTIAL METER	 VARIO COUPLER

MAGNAVOX

—THE "GREAT VOICE" IN RADIO—

Embodying the Greatest Achievement in Radio Engineering
"SINGLE DIAL CONTROL"

The Turn of a Single Dial Makes You Master of the Air

See the MAGNAVOX TEST TABLE on display at the Radio Show. This Test Table in our Service Department, the first and only equipment of its kind in the northwest, insures accurate and efficient service on sets and speakers through AUTHORIZED MAGNAVOX DEALERS.

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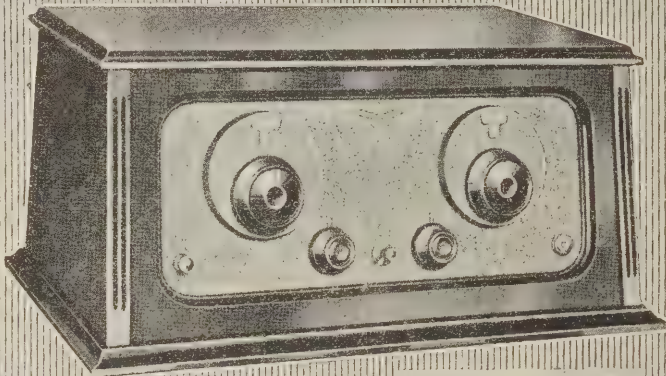
Ask for Our 1926-27 Radio and Phonograph Catalogue

SPLITDORF

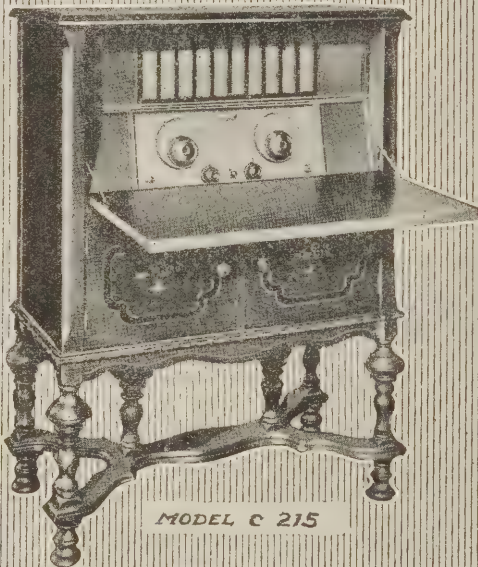
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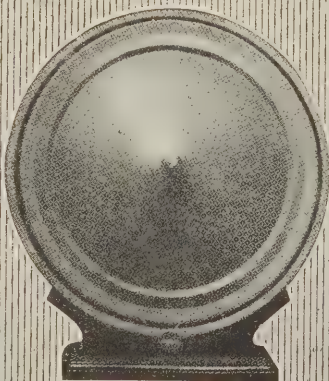
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MODEL R.V. 695



MODEL C 215



CONE TYPE SPEAKER

Reputation Alone Would Sell the Splitdorf

Built by a nationally known electrical equipment manufacturing institution with a successful manufacturing record of more than half a century. Distributed (wholesale) by a jobbing house—pioneers of the Northwest—who are established more than half a century. But—the enormous sales of the Splitdorf are due to reputation—plus.

The Splitdorf reproduces musical tones—the entire scale—with absolute fidelity. It places you within the presence of the artist. From whisper to ball room volume, the reproduction is perfect whether on low or high wave length.

The Splitdorf Super-Power switch (an exclusive feature) gives the listener complete command and control over all wave lengths, high or low.

Receivers of incomparable beauty; an outstanding achievement of the cabinet maker's craftsmanship. Built of American walnut. Model RV-580 Splitdorf Receiver. Five tubes. Two-tone walnut cabinet with sloping metal panel of dark brown crackle finish. Vernier dials. Super-power switch. Dimensions, 28x11x9 1/4 inches high. List \$80.00

Model RV-695 Splitdorf Receiver. Six tubes. Two-tone walnut cabinet with sloping metal panel of dark brown crackle finish. Vernier dials. Super-power switch. Dimensions, 22x12 3/4x10 inches high. List \$95.00

Model R-560 Splitdorf Receiver. Five tubes. Two-tone walnut cabinet with straight-down metal panel of ebony-crackle finish. Standard dials. Dimensions, 26 1/2x9 1/2x8 1/2 inches high. List \$60.00

Splitdorf Cone Speaker. Super volume and tone. Of beautiful, soft, dull gold finish. Stands 19 inches high. Can be placed on table, mantel, etc.; is also equipped with silk cord for hanging against wall List \$25.00

Model C-215 Splitdorf Console. Equipped with model RV-695 Receiver. Console of two-tone walnut. Beautiful in design. Substantial in construction. Elaborately carved. Dimensions, 32 1/2x17 1/2x44 1/2 inches high. Has built-in speaker. Two battery compartments. Wt., 96 lbs. List \$215.00

Model C-200 Splitdorf Console. Equipped with model RV-580 Receiver. Otherwise same as Model C-215 Console described above. List \$200.00

THE WILLIAMS HARDWARE CO.

WHOLESALE NORTHWESTERN DISTRIBUTORS

MINNEAPOLIS

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Rainville Furniture Co.,
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Albrecht, Rodine Co.,
2221 Central Ave.

Knaeble & Scherer,
513 Plymouth Ave.
Pearson & Swenson,
609 West Broadway
White Wander Furn. Co.,
2727 East Lake St.
Findley Electric Co.,
111 S. 6th St.

SPLITDORF MEANS RADIO SUPREMACY
THERE'S FAME IN THE NAME

Annual Convention Program

Noon-day Luncheons for Radio Distributors will be held at the Nicollet Hotel, Francis I Room, 12:15 p. m.

(Tentative program subject to change.)

MONDAY, SEPTEMBER 27, 1926

12:15 P. M. George H. Riebeth, president N. W. Radio Trade Association, presiding.

Opening Address by C. Reinold Noyes, Noyes Bros. & Cutler, Inc., St. Paul, Minn.

"How We Can All Work Together," by Harold W. Wrape, president of Federated Radio Trade Association.

TUESDAY, SEPTEMBER 28, 1926

12:15 P. M. Harry P. Smith, first vice-president N. R. T. A., presiding.

"Radio Broadcasting Conditions in Northwest," by Prof. C. M. Jansky, Jr., University of Minnesota.

"New Developments in Radio," by R. V. Sutcliffe, Radio Retailing, New York.

WEDNESDAY, SEPTEMBER 29, 1926

12:15 P. M. R. E. Brinser, second vice-president N. R. T. A., presiding.

"What Is a Radio Dealer?" by Paul Goldsborough, W. S. Nott Company, Minneapolis, Minnesota.

"The Northwest Radio Market," J. O. Maland, The Dakota Farmer and Farmstead, Stock & Home.

"Hardware Dealer in the Radio Business," by C. H. Casey, secretary Minnesota & South Dakota Retail Hardware Association.

THURSDAY, SEPTEMBER 30, 1926

12:15 P. M. W. M. Sanderlin, third vice-president N. R. T. A., presiding.
Geo. H. Lewis, general manager and vice-president Ken-Rad Radio Corporation, Owensboro, Kentucky.

"Selling Radio to Farmers," by R. E. Brinser, Madison Lake, Minn.

"Co-Operation Between Radio Jobber and Dealer," by H. H. Reinhard, Reinhard Bros. Company, Minneapolis, Minn.

6:00 P. M. Annual Banquet of Northwest Radio Trade Association, Nicollet Hotel Ball Room.

7:30 P. M. Annual Report of Executive Secretary-Treasurer, H. H. Cory.
Annual Election of Officers and Directors.
Addresses by Nationally Known Radio Men.
Special Entertainment.

FRIDAY, OCTOBER 1, 1926

12:15 P. M. J. O. Maland, secretary N. R. T. A., presiding.

"Profits in Radio," by Carl Boyd, Reichmann Co., Chicago, Ill.

"Radio Legislation," by H. A. Bellows, manager Gold Medal Station WCCO.

"Choosing Radio Lines," by S. Talbott, King-Buffalo, Inc., Buffalo, New York.

Wet Batteries

BY M. W. McMAHON
EXIDE BATTERY CO.

One of the most striking advances of radio in recent years is the development of the three element vacuum tube which is entirely dependent for its operation upon a reliable source of current supply. Power must be supplied to heat the filament so as to cause it to throw off free electrons. This power is supplied by the so-called "A" battery. The plate of the tube must be given a positive charge with respect to the filament to attract the electrons and form a low resistance path for the radio impulses. This positive charge is supplied by the "B" batteries. A third battery gives the grid a negative bias and is known as the "C" battery.

In all three cases a dependable, uniform supply of current is imperative and for this reason storage batteries have proven themselves to be a dependable source of supply. Several devices have been tried for furnishing the current for radio sets, some of which have proven more or less successful while others were complete failures. In the case of the "B" and "C" batteries, where a comparatively high voltage and small current drains are required, these devices have made the best showing, but in the case of the "A" battery, where low voltage and relatively higher current drains are required, the storage battery is by far the most popular with users of radio sets.

DIFFERENCE IN RADIO AND AUTOMOBILE BATTERIES

In purchasing an "A" battery the user is interested in the ampere hour capacity of the battery, its life or useful service period, its price and appearance. When radio first became popular many battery manufacturers, who were making batteries for automobile use, immediately placed them on the market for radio use. The service which is demanded of a radio battery is entirely different from that of an automobile service, and while the automobile battery will operate a radio set, it is not as satisfactory as a battery which is designed for radio service. The principal difference in the two batteries is the thickness of the plates and separators. Other things being equal, the ampere hour capacity of the battery depends on the amount of active material in the plates. In an automobile battery, where extremely high discharge rates are necessary in order to crank the car, there must be a considerable amount of active material exposed to the electrolyte. For this reason an automobile battery which has good

cranking ability is made up of a larger number of thin plates. A radio battery's work is entirely different as it is called upon to discharge its capacity over a long period of time at comparatively low discharge rates. A battery designed for one class of service is not suited to the other. When buying a radio battery, therefore, the user of a set should be sure that he is buying a battery designed for radio service.

RELIABLE TYPES OF STORAGE BATTERIES

How is the purchaser to know whether representations of the battery capacity are correct? Unfortunately it is rather difficult for the average purchaser because of the unscrupulous tactics of some manufacturers such as were exposed in the February, 1926, Bulletin of the National Better Business Bureau. These deceptions take the form usually of building a battery with an appearance indicating more plates than are actually used, the space being filled up with acid and separators.

This deceptive appearance is accomplished by using a massive case with square corners, high handles and thick walls; in fact a case altogether out of proportion to the class of service. The only way to play safe and get true value for your money in a radio battery is to buy the product of a trustworthy manufacturer from a trustworthy dealer, and see that the battery is plainly marked either as to capacity or type. On most of the batteries where deception is practiced, care is taken to avoid definite information on the battery as to size and capacity so as to avoid legal difficulties in connection with the verbal mis-statements usually made with that type of battery.

RULES FOR THE PROPER CARE OF BATTERIES

Battery service stations are so common now days that there is one or more in nearly every community. These battery stations all over the country are for the most part fully equipped and operated by expert battery men, and are at the service of the radio fan. For the benefit of those having their own charging facilities full instructions are included by most manufacturers with the batteries. The rules for the proper care of a battery are very simple and only three in number: Keep the outside of the battery clean and dry; keep the solution at the proper level with *PURE WATER ONLY*; keep the battery properly charged. This means that all so-called pat-

ent electrolytes and powders must be avoided. These have been exposed in various bulletins of the Better Business Bureau, the latest being August 25, 1926, and are also condemned in the recent book on storage batteries by G. W. Vinal of the United States Bureau of Standards. It must be remembered that cure-alls are usually deceptive and that the laws of electro-chemistry demand that a discharged battery must be charged electrically to give service. In other words, to quote the bulletin referred to above, "Let your service station dealer diagnose and prescribe for your battery ills, as your physician does for your bodily ills. Give your battery a chance to live and perform and render service. Don't dose it."

INSTRUCTIONS FOR CHARGING

Only direct current (D. C.) can be used in battery charging and where the available source of power is in the form of alternating current (A. C.), a rectifying device must be used to change the power from A. C. to D. C. Many makes of devices for this purpose are on the market and instructions for their operation may be secured from the manufacturers.

Charging of the battery may be done as frequently as may be convenient provided the

length of the charging period is proportioned accordingly. Frequent charging, not greatly in excess of actual requirements, insures having the power supply for the radio set at full voltage and capacity.

Many radio fans have simplified the operation of their storage battery power plant by the use of one or more double throw switches. These switches are so connected that when thrown to one position the batteries are connected to the set, and when thrown to the opposite position the batteries are connected to the charger.

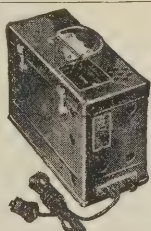
The power units on the market are a combination of a storage battery and charging unit properly designed to work together. This combination simplifies the care of the battery for the user and makes its operation almost automatic.

HYDROMETER TESTING

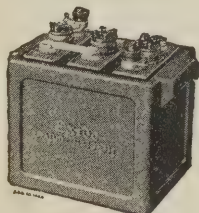
The scale reading on gravity testing hydrometers runs from 1,150 to 1,300, usually. The divisions are marked off as follows:

Fully charged	1,280 to 1,300
Half charged	1,240 to 1,250
Discharged	1,200

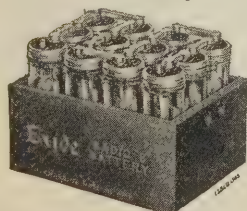
Keeping a battery only lightly charged or half charged will shorten the life besides not giving as good results on the set.



Exide Radio Power
Unit Model 2A
6-Volt



Exide 6-Volt
"A" Battery



Exide 24-Volt
"B" Battery

Exide RADIO BATTERIES

DEPENDABLE, NOISELESS POWER FOR EVERY
TYPE OF TUBE

Getting the most enjoyment from your radio set is largely a matter of proper current supply.

All the distance, volume and clearness that an ample, uniform supply of current gives to radio reception are yours when current is supplied by *Exide Radio Batteries*. There are Exide "A" and "B" storage batteries for every requirement and a rectifier for recharging "B" storage batteries.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia

Minneapolis Branch: 3 North 15th St.

See the Complete Line at Any Exide Dealer's or at
Radio Stores

STERLING ELECTRIC COMPANY
DISTRIBUTORS FOR
GENERAL RADIO APPARATUS



"B" Eliminator and Power Amplifier Kit
Includes All Parts Except Tubes
Price, No. 395 Kit, \$50.00

AMATEUR WAVEMETER

Range, 15 to 225 meters. Supplied with calibration curve with an accuracy of 1 per cent. Price....\$22.00

PRECISION CONDENSERS

These Condensers Are Unexcelled

LOW LOSS COILS

Cover All Ranges From 50 to 900 Meters

General Radio

Type 400 Rectron Power Amplifier and "B" Eliminator
Complete, Assembled Unit. Adds Unlimited Volume to Any
Set. Price, Less Tubes.....\$68.00

Bosch Armored Radio

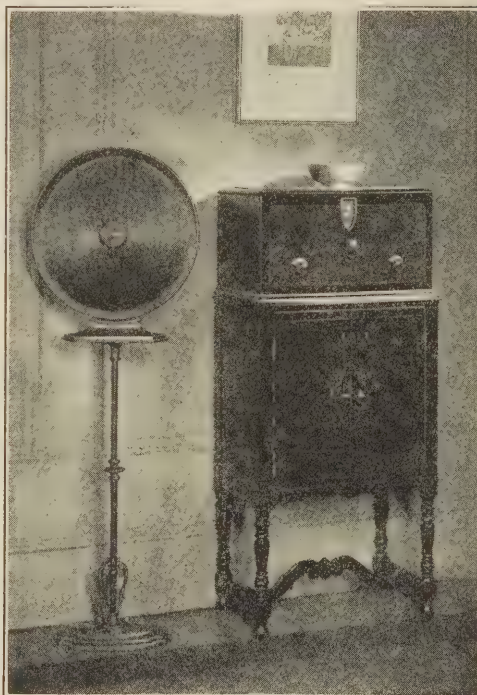
The Very Last Word in Comfortable Radio

The Cruiser (armored).....\$100.00
The Famous (R. S. 16)..... 150.00
The Amborada (armored)... 310.00
Bosch Nobattray 55.00
Concert Reproducer..... 27.50

STERLING RADIO

The ultimate in the low-priced field. Three beautiful models. All six-tube.

Table Model\$70.00
Console (Model 66)... 99.50
Console (Model 67)...134.50



The Cruiser Receiver—Cruiser Cabinet—The Reproducer—The Reproducer Stand (Metal)

STERLING ELECTRIC CO.

33 S. Fifth St., Minneapolis

Authorized Distributors for Bosch and Sterling Radio Receivers, General Radio, Gould Unipower, Radiotron Tubes and Other Well-Known Radio Apparatus

Radio Interference

Outside disturbance--What to look for and how to run them down.

BY H. H. CORY,
EXECUTIVE SECRETARY N. R. T. A.

The Northwest Radio Trade Association has been working very effectively in the last two years toward the running down and elimination of a lot of radio interference that has raised havoc with radio reception in different communities throughout the Northwest. It has not always been possible to find the trouble and get it corrected but much good work has been done.

Through the organization of Listeners' Clubs in many of the large cities of the territory, a complete check up has been affected on troublesome equipment in the various communities. The absolute co-operation of all radio set users in the community has been necessary and the association urges the organization of Listeners' Clubs in all the large towns in the territory.

There are ten classifications in the sources of radio interference and all are given in the present chapter so that those wishing to make a study of the question can have something to base their work on. In these different classifications, we mention a large number of possible causes, however, we have found that a large part of interference trouble is caused by apparatus and equipment being operated or under the control of the radio set user himself. A careful study of these causes will convince you that this is the case. It is our hope that more users of radio sets will interest themselves in the running down and elimination of radio interference as the co-operation of all listeners is the only solution to clearing up interference in any community.

The ten classifications are as follows:

1. STATIC

While static and fading are natural atmospheric interferences of the "roller" or "grinder" type, no positive means of elimination has yet been found. Loop aerials, low aerials, counter-poise aerials or extremely long aerials with no ground will bring in less static than other kinds. The volume of static may be reduced a little by tuning. We believe that inventors will eventually discover some method of screening a set from static or means of elimination either by some apparatus or the use of double loop aerials.

2. BROADCASTING STATION INTERFERENCE

There are three kinds of interference caused by broadcasting stations themselves. First is the heterodyning of one station on another. Sometimes this is due to the fact that the wave lengths of the stations are too close together, so that reception from the station which you have tuned in is marred by a distinct whistle caused by the other station and vice versa. At other times, this is caused by the variation of the station from their assigned frequency. The second cause of interference is the broad band emission of many stations. It is possible for a station to send out a sharp tuned wave, but many stations purposely use a broad wave so that the local listeners have to listen to them. The third cause of interference by stations is harmonics. You will note on your receiver that a station will come in at two or three stations on your

dials, unless it has a master oscillator circuit in use or is properly coupled. It is so simple and inexpensive to remedy this kind of trouble that all stations should be forced to do so. All three kinds cited above could be controlled by law if we had any law. Unfortunately, we have not and that is one of the very best of reasons why local radio clubs should be organized to see that we get the proper kind of laws.

3. COMMUNICATION SYSTEMS

Telephones, telegraph, fire and police signal systems. The interference set up by this class of equipment is not so very great, but there are some very definite kinds. Bell ringing generators used in the telephone companies can be heard for quite a distance of themselves in addition to which they feed back on the telephone lines which carry them into the homes of people. The automatic telephone system in some places causes trouble occasionally and others, always hearing the dialing of an automatic phone in their own receiver. In telegraph offices more large batteries must be kept charged, oftentimes charging apparatus become inefficient and worn out and sets up radio interference which is noticeable. If you have fire or police signal systems in operation, occasional short circuits due to ground may occur which may cause trouble.

4. TRANSPORTATION SYSTEMS

Street railways may cause some interference from sparking in trolley wheel or due to a flat street car wheel. Cracked insulators sometimes set up trouble and poor bonding between rails on the road bed will cause interference as the car approaches and passes. Interference caused by street railways is much easier to check up than almost any other kind. Steam and electric road equipment that sometimes causes trouble is the crossing bell and electric block signals in the town. Many times temporary interference is noticed when a passenger train is passing through a town due to battery chargers under the passenger cars, or worn out electric fans in the cars, or short circuits on the lighting system in general.

5. ELECTRIC LIGHT AND POWER APPARATUS

Interference caused by power companies is divided into two classes—that which emanates from the main plant or sub-station apparatus and that which occurs on the lines. Loose brushes on generators sometimes cause sparking and occasionally rectifier tubes in use at sub-stations become inefficient. On the line equipment, the most frequent cause is tree limbs having rubbed the insulation off the electric wires and allowing the current to leak to the ground. Swinging arc lamps sometimes cause trouble or the improper operating of the arc lamp. Transformers occasionally develop a leakage and sometimes a break may occur in buried conduit systems.

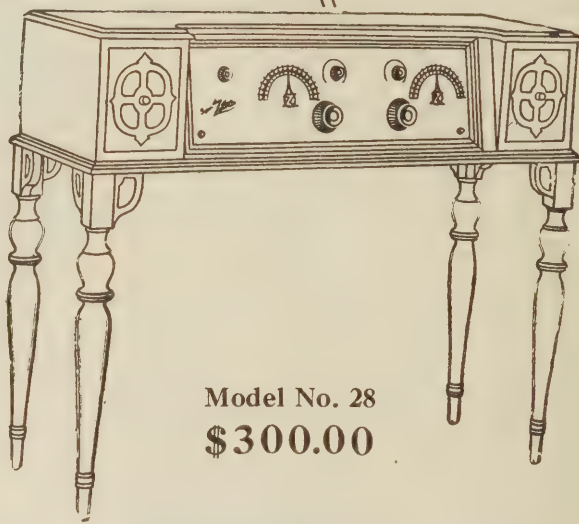
(Continued on page 21)



Costs more – but Does more

Demonstration of
Famous Zenith Bat-
teryless Set in Booths
Nos. 102 and 104.

Electrical Radio



Model No. 28
\$300.00

No CHARGER—No ACID

(Simply Connect To The Light Socket)

Power and Tone Quality heretofore impossible in Radio

Its only claim to superiority is by comparison with other sets. Come to our booth and experience the ecstasy of listening to the most wonderful of all Radios.

A demonstration will convince you of its absolute exclusiveness in design and assembly, with features of excellence which place the Zenith set far in advance of any other make. Made and guaranteed by Zenith Radio Corporation.

Hall Hardware Company

MINNEAPOLIS, MINNESOTA

Distributors for all of Minnesota and Northwestern
Counties of Wisconsin.

(Continued from page 19)

6. RADIATING RECEIVING SETS

These have become known as "bloopers." A blooper is a regenerative receiving set having no radio frequency tube between its detector tube and the antenna. The improper tuning of the tickler coil allows the feeding back of the regenerative wave directly onto the antenna which throws it off exactly as a broadcasting station does. You hear a loud squeal or squawk as the person who owns the blooper set turns his dials around. This kind of sets are causing all kinds of trouble and radio clubs should discourage the use of this type of set and persuade people to buy other kinds if possible. Eventually we hope there will be legislation against the manufacture and sale of this kind of sets as they are certainly a public nuisance.

7. DEFECTIVE RADIO SETS AND EQUIPMENT

A great many kinds of interference that shows up are caused by some trouble in the man's own set. Here are some of the causes: 1. Rundown "A," "B," or "C" batteries. 2. Rundown vacuum tubes. 3. Broken transformer windings. 4. Contact between condenser plates. 5. Contact between terminals on jacks. 6. Loose sliding contacts on rheostats or potentiometers. 7. Loosely connected or worn-out head phones or loud speaker. 8. Interference of fields due to setting of coils. 9. Loose connections or broken wires of any kind. 10. Audio frequency howls due to resonance in the amplifier circuits. It behooves everyone to check over his own set before turning in any public complaint on interference.

8. AMATEUR RADIO STATIONS

The senders of code a while back used to cause quite a bit of trouble by sending at the time other broadcasting stations were on, but now that they have found that their most efficient wave length is about 45 meters, you very seldom hear an amateur code operator.

9. SHIP RADIO STATIONS

In some parts of the United States, especially along the sea coast, a great deal of radio interference is caused by the code stations on board foreign ships, as these stations are licensed on wave lengths which sometimes interfere with our own schedules.

10. ELECTRICAL APPARATUS IN HOME OR COMMERCIAL USE

Probably the largest percentage of causes of radio interference is the electric equipment in the homes, factories or offices of radio users themselves. Apparatus that causes trouble are such things as fans, vacuum cleaners, dish-washing machines, mangles, oil burners, washing machines, coffee grinders, meat grinders, sign flasher motors, refrigerator motors, sewing machines, massage vibrators, drink mixers, phonograph and piano motors, hair dryers, hair clippers, milk separators, battery chargers, violet ray machines, lighters, heating pads, soldering, curling and waffle irons, percolators, water heaters, toasters and, in fact, anything electrically operated that is in use. Furthermore, the loose connections in wall receptacles or heating iron plugs will cause as bad interference as anything else. The first thing that everyone should do, who is having radio interference, is to turn on the interference in the radio set and then pull off the light switch for the whole house to see if the trouble stops,

and then test each electric piece in the house. Commercial apparatus that sometimes causes trouble is sign flashers, mercury arc rectifier tubes, farm lighting plants, elevator motors and doctors' X-ray machines.

The hopeful part of all radio interference is that there is no radio interference which cannot be located, run down and eliminated. You cannot do it alone by having a large sum of money appropriated to do the job, you must furnish man power for the checking up of the area covered by the interference and the locating of the exact cause by either an exploring coil on the end of a fish pole attached to the radio or a direct finding loop aerial set. Results do not come quickly and you sometimes have to work a long time.

Generally, you are able to secure the greatest co-operation and assistance from all public service companies and from the city water and light boards and engineers. Where this co-operation cannot be obtained the radio club can be of greatest use by having a large committee make a definite appointment with the officers whose co-operation you are trying to secure and simply bring a great deal of pressure to bear on these men and get them to co-operate with you. Single users of a radio set can get nowhere with a large company in making an individual complaint. There must be a big, strong organization behind a real complaint to get action.

The local newspapers must also be sold on the idea of assisting radio listeners to get their rights and the local papers can be of the greatest assistance in the world in helping the radio listener.

The Northwest Radio Trade Association is sponsoring and advising the organization of radio listeners' clubs in every city in the Northwest, to do the things outlined above. These clubs are invited to affiliate with the Northwest Radio Trade Association, to secure the benefits of its wide experience in the promotion of the radio art. No financial aid is required by the association for the affiliations of the local clubs. It advocates a yearly dues per member of \$1.00 or \$2.00 apiece, this money to be used entirely in the local city for the cleaning up of interference troubles and the purchasing of proper equipment. The N. R. T. A. does not believe in local clubs paying a large sum of money to the so-called National Associations of Listeners as in the management of these associations will be found to be privately organized companies, playing on the ignorance of people as to what they should really do to help themselves. The only return which the N. R. T. A. expects in any way is that the radio dealers of the town hold an active membership in the N. R. T. A. so that the proper contact can be maintained with each community and the work carried on.

The only piece of corrective apparatus for radio interference that we know of that is on the market at present is the Cook Radio Clarifier. This is a little square box containing pieces of apparatus consisting of choke coils, condensers, resistances and fuses which you can hook right across the terminals of any offending piece of electric equipment. It has stopped the trouble in a great many cases. The clarifier lists for \$10.00 each. You can buy separate condensers, choke coils and resistances and make up your own apparatus, but the time and trouble to do this is very often much more than the cost of the above mentioned article.

The attached interference complaint form is used quite extensively by the N. R. T. A. It consists of 24 questions which the interference complainant has to fill out. It is then turned over to the Interference Committee who runs down the trouble and attempts to eliminate it.

NAME ADDRESS TEL.....

This is a free RADIO INTERFERENCE SERVICE maintained by the NORTH-WEST RADIO TRADE ASSOCIATION. We are making a thorough survey of the Radio Interference problem and trying to eliminate what trouble we can locate. This is expensive work and each personal call costs us about \$2.00, so please cooperate by being sure first that the trouble you have is not in your own set or equipment. We cannot promise when we will call on you, but will arrange appointment by telephone ahead in most cases. Do not report anything over ten days old. These complaint forms are found in the stores of our members only.

DON'T FILL OUT BLANK UNTIL YOU HAVE GONE HOME AND CHECKED OVER THE QUESTIONS ON YOUR OWN SET.
ANSWER THE FOLLOWING QUESTIONS

1. Manufacturer's name on set..... Number and type of tubes.....
2. Bought tubes..... Last tested or rejuvenated.....
3. Do your tubes flicker when tapped gently?..... Are they tight in socket?.....
4. Does your set re-radiate and interfere with other sets?.....
5. Have you tightened up all inside and outdoor connections lately?.....
6. Type of batteries used? A..... B..... C.....
7. When did you buy or recharge them? A..... B..... C.....
8. Date and reading of last voltmeter tests on batteries? A..... B..... C.....
9. To what is your ground wire fastened?..... Soldered or clamped on?.....
10. Aerial height..... Length..... Parallel to other wires?.....
11. Is leadin separate wire?..... Is it insulated and tightly soldered?.....
12. Is aerial insulated from all trees, ground, houses, etc.?.....
13. Is it fastened to telephone or electric light poles or cross over their wires?.....
14. With aerial and ground wires disconnected and their binding posts connected with a wire, do you still get the interference?..... What time of day or night do you hear it?
15. What do you think is causing interference in your set?.....
16. Does the time and character of interference indicate what the cause might be?....
17. Does the interference hum, hiss, roar, squeal, tap, buzz, crash, surge or seem to accumulate and discharge?
18. About what wave length does it come in loudest?..... How many points on your dial does it cover?.....
19. Is it continuous or at intervals?..... Steady or intermittent?.....
20. Does it continue when you pull lighting switch for your whole house?.....
21. Have you asked any neighbors to pull their switches?.....
22. Any electric socket, switches or fixtures in your house with loose connections?.....
23. Do you or anyone in your neighborhood operate oil-burning furnace, heating pad, small motors, violet ray machines or other electric appliances?.....
Ever turn them on and off to see if they might be causing the trouble by sparking?.....
24. Give names and addresses of other radio set owners in your neighborhood who are having the same trouble you are having

ATTESTED TO BY RADIO DEALER..... DATE AND HOUR.....
(Member of Northwest Radio Trade Association)

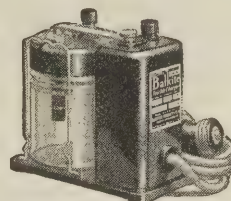
The New Balkite Radio Power Units

Operate your radio set from the light socket



The New Balkite Charger

MODEL J. Has two charging rates. A low trickle charge rate and a high rate for rapid charging and heavy duty use. Can thus be used either as a trickle or as a high rate charger and combines their advantages. Noiseless. Large water capacity. Visible electrolyte level. Rates: with 6-volt battery, .25 and .5 amperes; with 4-volt battery, .8 and .2 amperes. Special model for 25-40 cycles. Price \$19.50. [West of Rockies \$20.]



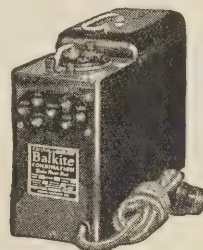
Balkite Trickle Charger

MODEL K. With 6-volt "A" batteries can be left on continuous or trickle charge thus automatically keeping the battery at full power. Converts the "A" battery into a light socket "A" power supply. With 4-volt batteries can be used as an intermittent charger. Or as a trickle charger if a resistance is added. Charging rate about .5 amperes. Over 200,000 in use. Price \$10. [West of Rockies \$10.50.]



A New Balkite "B" at \$27.50

Balkite "B" eliminates "B" batteries and supplies "B" current from the light socket. Noiseless. Permanent. Employs no tubes and requires no replacements. Three new models. The new popular priced Balkite "B"-W at \$27.50 for sets of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X, for sets of 8 tubes or less; capacity 30 milliamperes at 135 volts—\$42. Balkite "B"-Y, for any radio set; capacity 40 milliamperes at 150 volts—\$69.



Balkite Combination

When connected to the "A" battery this new Balkite Combination Radio Unit supplies automatic power to both "A" and "B" circuits. Controlled by the filament switch on the set. Entirely automatic in operation. Can be put either near the set or in a remote location. Will serve any set now using either 4 or 6-volt "A" batteries and requiring not more than 30 milliamperes at 135 volts of "B" current—practically all sets of up to 8 tubes. Price \$59.50.

All Balkite Radio Power Units operate from 110-120 volt AC current with models for both 60 and 50 cycles. Prices are higher in Canada

FANSTEEL
Balkite
Radio Power Units

Manufactured by FANSTEEL PRODUCTS COMPANY, Inc., North Chicago, Illinois



NICOLLET HOTEL BARBER SHOP

O. S. BACON, Proprietor

Valet Service—Hat Blocking—Manicuring
Ladies' Barber Shop

MINNEAPOLIS,

MINN.

Northwest Distributors of Gilfillan Neutrodyne Radiodyne Holmes-Jordon



RADIO RECEIVING SETS—also a complete line of
Radio Set Accessories

WESTERN MOTOR SUPPLY CO.

Minneapolis, Minn.

Broadcasting and The Listener

BY H. A. BELLOWES
MANAGER GOLD MEDAL STATION WCCO

"Let's turn on the radio!" Every day people are saying this in hundreds of thousands of homes, because in the brief space of five years radio has become an integral part of American life. Into each of these homes, by the mere operation of a switch, comes a miracle which would make the wildest fancies of the Arabian Nights seem commonplace, and yet, so quickly is a habit formed, we already take this miracle entirely for granted. More than that, because as listeners we pay nothing for what the receiving set brings to us, we reserve the right to grumble and find fault, and to wonder why on earth the broadcasting stations cannot provide programs better adapted to our special moods and tastes.

WHAT THE PUBLIC EXPECTS

Let us stop and think for just a moment what the broadcasting station is called upon to do. The Gold Medal Station, for example, is actually broadcasting about seventy hours a week, and program material must be provided for every one of those seventy hours. Even so, there is hardly a fifteen minute period of silence when somebody does not call up indignantly to ask why the station is not on the air. The audience ranges

all the way from the St. Paul and Minneapolis city people to the settlers on farms fifty miles from a railroad, the trappers of the far North, and the long-distance radio hounds from Maine to California. It is not enough to try and satisfy all these listeners by turns; each one of them feels entitled to just the kind of program he or she wants whenever the dials are set to pick up WCCO.

Such is the problem which confronts the program director of almost any large broadcasting station. Nor is that all. The day has long since passed when listeners would be satisfied with almost any kind of radio performance; there are so many good programs on the air that the public has become exceedingly critical. Whether it be jazz or Beethoven, a vaudeville turn or a church service, the radio program of today must be excellent in quality or the unfavorable reaction will be prompt and vigorous.

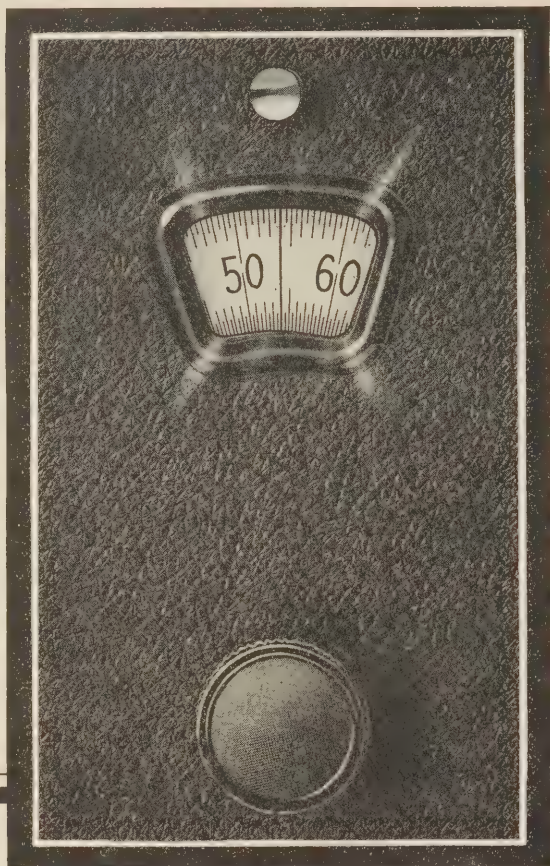
WHO PAYS FOR THE PROGRAMS?

Now, quality in radio programs, as in everything else, costs money. From the very beginning, the outstanding question with regard to broadcasting has been: "Who is going to pay for it?" In many foreign coun-

(Continued on page 27)



Electrical Engineering Building, University of Minnesota. (The University Experimental Radio Station WLB and communication laboratories occupy the third floor of this building.)



ON THE new set you build—or the old one you remodel—replace dials with these sensational new controls. When you turn the switch, a soft illumination glows through the window, lending swifter readability to the scale, and flashing beauty to the panel.

They fit all condensers. Mazda lamp and template included, at \$3.50 each. Standard equipment in the majority of this season's most popular circuits. Send for booklet.

MARTIN-COPELAND COMPANY,
Providence, R. I.

MAR·CO *Illuminated* **CONTROLS**

"SERVICE ON ALL MAKES"



The Largest Place of Its Kind in Minneapolis With the Most Modern Facilities
A Complete Line of Radio and Automobile Batteries

Willard Storage Battery Company

Factory Branch Store

55 South 12th Street

Geneva 9194-95

(Continued from page 25)

tries the answer has been found by making broadcasting a government institution, and supporting it by taxes on radio sets and parts. This is certainly not in accord with American tradition, and every one hopes that such a solution of the problem will not be found necessary.

At present, broadcasting is largely maintained by individual business organizations which use it to create general good will. This, however, is economically just as unsound as it would be to have our newspapers similarly controlled. Broadcasting is fast becoming a public service, and it is the sole basis for a business in radio sets and parts which now amounts to more than half a billion dollars a year. To keep this business alive, the radio stations are today spending something like twenty million dollars a year for maintenance and programs. Everything indicates that this vast expense will increase rather than decrease as time goes on.

BROADCASTING A GOOD ADVERTISING MEDIUM

The solution is apparently to be found in the fact that every means of communication which reaches a large number of people is a possible medium for advertising. It is advertising which makes it possible for you

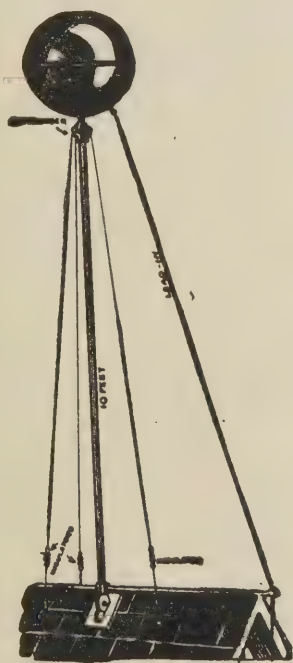
and me to buy a newspaper for three cents, less than the actual cost of the paper on which the news is printed; it is advertising which puts into our hands magazines at prices less than the cost of getting them from the publishing houses to our homes. Similarly, it is advertising which is giving us the best radio programs on the air. National advertisers, using the wire network built up by the American Telephone & Telegraph Company, are giving the public radio service ranging all the way from symphony concerts to lessons in bridge; regional advertisers are providing programs fully as good as those on the national network.

GOOD PROGRAMS ON THE INCREASE

Just now radio good will advertising is very much on the up-grade. During the season which is just opening, radio listeners are assured of far better programs than ever before. From the Gold Medal Station, for example, they will receive programs which, in the actual sums paid to the artists, represent more than half a million dollars.

How long will this continue? This question is absolutely for the listeners themselves to answer. Large advertisers will spend their money for good radio programs just as long

(Continued on page 29)



Super-Ball Price

New Improved **Super Ball** [ANTENNA "For Better Radio"

Wires are to a certain extent directional. The Super-Ball is non-directional. It receives all wave lengths from every point. It brings in the stations with greater clarity and volume; makes a poor set good and a good set better.

Easy to install and less costly. Lasts a lifetime in rain, snow or ice. No dangerous wires to fall across current cables.

*Approved Under National Electric Code and
by National Board of Fire Underwriters*

Remember this—an insect is lost without its antennae, or feelers. Same is true of radio.

"It's all in the Antenna"

Northwestern Distributors

Reiber Sales Company

University at Raymond

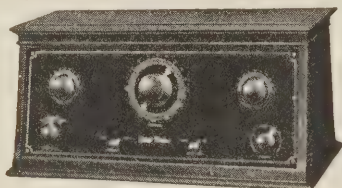
St. Paul, Minnesota

DAY FAN RADIO RECEIVERS

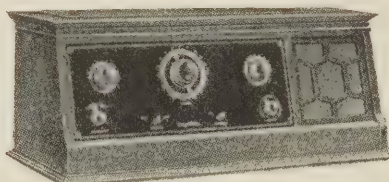
The only receiver so accurately made that it is sold with a complete air telephone directory for finding stations. A truly single control receiver with exceptional musical tone quality.

Best for the Following Seven Recommendations:

1. True single dial control.
2. Unequalled musical tone quality. It brings in the bass.
3. Great selectivity and volume without sacrifice of tone quality.
4. Beauty of design and craftsmanship.
5. Station numbers found for you in advance (pre-logged).
6. The only set with an air telephone directory.
7. Built and guaranteed by a company with 37 years of successful electrical experience.



Single dial, straight line condensers, exceptional tone quality, excellent volume and selectivity. Inclined panel of bakelite with gold markings. High-grade mahogany cabinet with lacquer finish. Has selectivity adjustments, loud and soft speaker switch, filament switch and volume control. Pre-logged, graduated both for air telephone directory and in meters.



Day Fan, 5-tube lists.....\$89.00
Day Fan, 6-tube lists.....100.00
Day Fan, 7-tube lists.....115.00

See Our Complete Day Fan Line of Receivers—Booth No. 126

FARWELL-OZMUN-KIRK CO.

Northwest Distributors

St. Paul, Minn.



DAYCRAFT
7—7-TUBE

This is the Day-Fan 7 in a Daycraft cabinet with built-in speaker. The speaker in this cabinet is a further development of the Day-Fan laboratories and produces an exceptional volume and quality of tone. The tone chamber has a total length of 4½ feet and the unit is especially designed for this tone chamber.
Lists\$150.00

Daycraft 7 With Console Base

DAYCRAFT CONSOLE BASE

The illustration shows a Daycraft set on the new console base which fits either the five, six or seven Daycraft. It is a beautiful piece of mahogany furniture with double door compartment sufficient for all batteries or eliminators. It is sold separate from the Daycraft. Size, 30 inches wide, 26½ inches high, 13¾ inches deep.

Lists\$24.50

WE SELL RADIO ENTERTAINMENT

Buy a Radio Set From Findley and You Need Not Be Concerned About the
Tubes, the Batteries, or What Not

We Sell You the Thrill and the Enjoyment of Those Distant Programs With
the Minimum of Tuning or Adjusting

The Priess Straight 8 Loop Receiver

The Concert Grand of Radio Gives the Desired Result

LET US MAKE A DEMONSTRATION IN YOUR HOME

FINDLEY ELECTRIC CO.

THE BEST IN RADIO SETS, PARTS AND ACCESSORIES

Our Service Men Will Call at Your Home, Examine Your Radio Installation
and Advise What Changes Should Be Made to Obtain Mamimum Results

Exhibit Space No. 16, 111 So. 6th St.

Geneva 9291 (Six Trunk Lines)

(Continued from page 27)

as they are getting results in increased sales, and no longer. To some extent, they will measure the effectiveness of their radio publicity by the actual mail received, but the final test is the public demand for their products.

HOW LISTENERS MUST CO-OPERATE

This means that two things are asked of the radio listener. First, letters of commendation regarding such commercial radio programs as he enjoys. Second, the purchase of radio-advertised products. This does not imply, of course, that anybody is asked to buy goods which he does not want, or goods which are not intrinsically worth their price; it simply involves giving preference to commodities which are advertised by means of well planned and well executed radio programs.

Day by day the number of radio listeners increases, and thus the potential effectiveness of radio advertising becomes steadily greater. The medium may, of course, very easily be misused, and here again the future is in the hands of the listening public. If a broadcasting station makes itself a nuisance through the character of its programs, through faulty transmission, or through its location at such a point that it prevents the reception of

programs from all other stations, it is up to the listeners to indicate that the offending station is creating, not good will, but ill will. If an advertiser insists on broadcasting programs which give offense, it is for the listeners to tell him so, and thereby show him the error of his ways.

THE FUTURE OF BROADCASTING

The future of radio—or broadcasting, of the radio trade, and above all of the radio listener—is just as dependent on what each radio fan does about it as the political future of our country is dependent on the individual voter. If you and I, as listeners, want a million dollars' worth of programs given to us for nothing every year, we can have them, but we cannot get them by sitting back and doing nothing. We must do our share in proving to the advertisers who are paying the bills that their messages are reaching us; we must write letters often enough to give them some idea of the extent of their audiences, and, most of all, we must let radio advertising have due weight with us in our purchases of advertised commodities.

The broadcasting stations are eager to serve you; the advertisers are already spending vast sums to give you better entertainment over the air. What are you going to do about it?

AMPLION

Cone-Horn
and
Cabinet Speakers



BOSWORTH RADIO SETS



Lightning Arresters
and
Radio Accessories

HOLMES

Chargers and B
Eliminators

Q
U
A
L
I
T
Y

Merchandise Is Our Standard



Cabinets—Loops
Condensers



Radio Wire

THE KOWFELDT CO.

Northwest Representatives
529 7th St. S.
Minneapolis, Minn.

MAXIMITE

BATTERIES

OFFICIALS
NORTHWEST RADIO TRADE ASSOCIATION



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NORTHWEST RADIO TRADE ASSOCIATION



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MODEL	USE	GRID CONDENSER M.F.D.	GRID LEAK (See Note 4)	DETECTOR GRID RETURN LEAD	"A" BATTERY VOLTS (SUPPLY)	FILAMENT TERMINAL VOLTS	"A" BATTERY CURRENT AMPERES	"B" BATTERY VOLTS DETECTOR	"B" BATTERY VOLTS AMPLIFIER	NEGATIVE "C" BATTERY VOLTS	PLATE CURRENT MILLIAMPERES (See Note 1 & 3)	OUTPUT RESISTANCE OHMS (See Note 1)	MUTUAL CONDUCTANCE MILLIAMPERES PER VOLT (See Note 1)	VOLTAGE AMPLIFICATION FACTOR (See Note 1)	MAXIMUM DIAMETER OVERALL	MAXIMUM HEIGHT OVERALL
UV-199	Detector Amplifier	00025	2 to 9	F	4 5	3.0	0.6	45	90	4 5	2 5	15,000	415	6.25	1 1/8"	3 1/2"
UX-199	Detector Amplifier	00025	2 to 9	F	4 5	3.0	0.6	45	90	4 5	2.5	15,000	415	6.25	1 1/8"	4 5/8"
UV-200	Detector Only	00025	1/2 to 2	F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 3/4"	4 1/8"
UX-200	Detector Only	00025	1/2 to 2	F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 13/16"	4 7/8"
UV-201-A	Detector Amplifier	00025	2 to 9	+F	6	5	25	45	90	4 5	3	12,000	675	8	1 13/16"	4 5/8"
UX-201-A	Detector Amplifier	00025	2 to 9	+F	6	5	25	45	90	4 5	3	12,000	675	8	1 13/16"	4 7/8"
W0-11	Detector Amplifier	00025	3 to 5	+F	1.5	1.1	25	22 1/2	90	4 5	2.8	14,000	400	5.6	1 5/8"	3 3/4"
W0-12	Detector Amplifier	00025	3 to 5	+F	1.5	1.1	25	22 1/2	90	4 5	2.8	14,000	400	5.6	1 7/8"	4 7/8"
WX-12	Detector Amplifier	00025	3 to 5	+F	1.5	1.1	25	22 1/2	90	4 5	2.8	14,000	400	5.6	1 7/8"	4 7/8"
UX-112	Detector Amplifier	00025	3 to 5	+F	6	5	0.5	22 1/2 to 45	135 (See Note 2)	10 5	7 9	4800	1620	8.0	1 13/16"	4 11/16"
UX-120	Audio Amplifier (Voltage Only)	—	—	—	4 5	3.0	125	—	135	22.5	6.5	6,600	500	3.3	1 1/8"	4 1/8"
UX-210	Amplifier Oscillator	—	—	—	8	7 1/2	1 1/2	—	45	35	22	2000	1550	7.75	2 3/8"	5 5/8"
UX-874	Voltage Regulator Tube	—	—	—	4	7 1/2	1 1/2	—	135	10 5	5.8	5500	1435	7.9	2 1/8"	5 5/8"
UV-876	Ballast Tube	—	—	—	4	7 1/2	1 1/2	—	135	10 5	5.8	5500	1435	7.9	2 1/8"	5 5/8"
UV-877 (See Note 1)	Protective Tube	—	—	—	4	7 1/2	1 1/2	—	135	10 5	5.8	5500	1435	7.9	2 1/8"	5 5/8"
UX-213	Full Wave Rectifier	—	—	—	4	7 1/2	1 1/2	—	135	10 5	5.8	5500	1435	7.9	2 1/8"	5 5/8"
UX-216-B	Half Wave Rectifier	—	—	—	4	7 1/2	1 1/2	—	135	10 5	5.8	5500	1435	7.9	2 1/8"	5 5/8"

NOTE 1 At normal operating grid voltage (Not at zero grid)
 NOTE 2 Plate voltage for average use is 90 to 135 volts
 NOTE 3 "R M S" indicates "Root Mean Square" as indicated on an A. C. voltmeter.
 NOTE 4 Connection to shell of base for third terminal which is the lead to mid-point of filament.
 NOTE 5 The plate current values given are less than those obtained with zero grid, but are the currents actually obtained when the tube is operated at indicated values of plate voltage and grid bias voltage

NOTE 6 The symbol \ominus indicates meagans
 NOTE 7 When 6 volt supply is used, no rheostat is required

VACUUM TUBE CHARACTERISTICS

Vacuum Tube Characteristics

BY C. H. McCASLIN,
STERLING ELECTRIC CO.,
MINNEAPOLIS, MINN.

Before discussing the operation and characteristics of vacuum tubes, it would be well to acquaint ourselves in a small way with the development of the detector.

Previous to the advent of radio broadcasting as we now know it, wireless communication was entirely carried on with the telegraph code and by means of spark and arc transmitters. The detectors used at this time were much different from our present-day vacuum tube, and were as follows:

Galena, Silicon, Lincite, Bornite, Carborundum.

Cerussite, Marconi Magnetic, Tikker.

Tone Wheel, Fleming Valve and the Three-element Valve.

Carborundum was considered the best of the crystal detectors as it is very rugged and its adjustment is quite stable. The Marconi magnetic detector was universally recognized as being the most stable and "fool-proof," but it lacked sensitiveness on short waves. The vacuum valve was conceded to be the most sensitive of the commercial detectors, but it possessed the disadvantage of requiring complicated circuits for best results.

The three-element valve is a modification of the Fleming two-element valve and consists of a filament, a grid and a plate. The grid is placed in the path of the electrons flowing from the filament to the plate and acts as a shutter, opening and closing as the incoming alternating current signal is rectified, that is, the grid at one instant allows the current to pass through and the next instant blocks the flow, thereby cutting off half of the cycle and transforming the energy to a pulsating direct current. In radio broadcasting frequencies the change occurs as often as three million times a second.

Our present vacuum tube is a development of the original three-element valve and is fundamentally the same in construction and operation, although far more delicate and sensitive.

At the present time there are fifteen types of vacuum tubes used in radio receiving apparatus and they may be classed as follows:

GENERAL PURPOSE TUBES, or tubes that may be used as either detectors or amplifiers.

Type 199—For 3-volt dry cell operation.

Type 201A—For 6-volt storage battery operation.

Type WD 11—For 1½-volt dry cell operation.

Type WX 12—For 1½-volt dry cell operation.

DETECTOR TUBES—

Type 200—For 6-volt storage battery operation.

Type 200A—For 6-volt storage battery operation.

POWER TUBES—

Type 210—For 6 to 8-volt storage battery operation.

Type 171—For 6-volt storage battery operation.

Type 112—For 6-volt storage battery operation.

Type 120—For 3-volt dry cell operation.

RECTIFYING TUBES—

Type 213—A full wave rectifier.

Type 216B—A half wave rectifier.

SPECIAL PURPOSE TUBES—

Type 874—Voltage regulators.

Type 876—Ballast lamp.

Type 877—Protective tube.

Then there are the tubes which are used in the broadcasting stations for transmitting the output of the station to our receiving sets. These tubes are built on the same principle as are the receiving tubes,

but are many times larger and more costly. Some of the tubes used in the larger broadcasting stations cost as much as \$400.00 and their life is not as long as that of the average tube used in a modern receiving set.

PURPOSES OF TUBES

The type 199 tube may be used as a detector as well as a radio or audio frequency amplifier. It is designed to operate on dry or wet batteries and has a current consumption of .06 of an ampere.

The type 201-A is the standard storage battery operated tube and may be used either as a detector or radio or audio frequency amplifier. The type of filament in this tube makes for low battery consumption, high amplification and long life.

The types WD 11 and WX 12 tubes have identically the same characteristics and are alike except for their base. Designed to operate on one cell of dry battery, they are very popular in portable sets.

The type 200 is the oldest of the present-day vacuum tube family and has been a favorite for years with many who desired more sensitivity than could be had with the "hard" tubes. It is designed for storage battery operation with a current consumption of one ampere.

The type 200-A is the newest member of the tube family, and is a super-sensitive, non-critical detector tube. Its plate and filament characteristics are the same as those of the 201-A type. It has a special gas content which gives it its smoky appearance.

Without any change to the set, it can be placed in the detector socket of any storage battery receiver. The increase in volume on faint, distant signals is often equivalent to an added stage of radio frequency amplification.

The type 210, the most powerful receiving tube made, is designed to provide enormous output of undistorted quality for the operation of the largest power speakers. It is also extensively used in amateur transmitters.

The type 171 fills a place just below that of the 210 and meets the demand of the user who desires more power than can be had from the ordinary amplifier tube and yet not as much power as is delivered by the 210.

The type 112 is a power tube designed for use in the last stage of audio frequency amplifiers of storage battery operated sets. The use of this tube will result in a remarkable improvement in volume and tone quality.

The type 120 is also a power tube, for use in the last audio stage of dry cell operated receivers.

The type 213 is a full wave rectifier for use in certain types of "B" eliminators now on the market.

The type 216-B, a powerful half-wave rectifier, is also for "B" eliminator operation and is used very extensively in the new electrically operated phonographs.

The type 874 is designed to be used as a voltage regulator tube on certain types of "B" eliminators and automatically compensates for fluctuations in the output voltage.

The type 876 is also a voltage regulator or ballast lamp and functions the same as the 874 on other types of radio apparatus.

(Continued on page 35)

Radio Terms

Aerial Antenna: A suspended wire for receiving radio energy.

Ammeter: A device to measure the flow of current.

Binding Posts: Fixtures, generally of metal, made to receive ends of wire for electrical connections.

Busbar: Thin copper wire having a square cross section.

Capacity: Ability to receive or hold an electrical charge.

Cat Whisker: Thin wire used in connection with the crystal detector.

Choke Coils: Coils of wire bound on iron cores which resist fluctuations of current.

Circuit: The path through which current flows.

Circuit, Closed: The circuit which gives the current a continuous path.

Circuit, Open: A circuit which does not give the current a continuous path.

Circuit, Grounded: A circuit which has a direct connection to the earth.

Coil: A continuous series of turns or rings of wire.

Condenser: A number of thin sheets of tin foil laid on top of each other and separated by an insulator.

Condenser: An appliance for storing electrical energy. Total capacity will be increased when condensers are placed in multiple. Total capacity will be decreased when condensers are placed in series.

Condenser, Adjustable: A condenser which has a variable capacity.

Core: The center of a transformer consisting of iron on which are the primary and secondary coils.

Crystal Detector: A detector made of a crystal and cat whiskers to rectify oscillations. Crystals are usually made of galena, silicon and carborundum.

Current: A flow of electrical energy in a conducting medium.

Current, Direct: A current that flows continuously in the same direction.

Current, Alternating: An electrical current that uniformly changes its direction of flow.

Cycle: A cycle is one complete change in the direction of flow of electrical energy.

Detector: An apparatus that changes radio frequency oscillations into audio frequency oscillations.

Diaphragm: A thin metal disc in the telephone receiver which vibrates due to electrical impulses giving audible sounds.

(Continued on page 37)

SIGNS

Of All Descriptions



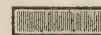
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*Official Sign Makers of
Radio Show*

BRIGHT STAR RADIO BATTERIES



"Supreme in Every Test"



THE HALL SUPPLY CO.

253 3rd Ave. So.

MINNEAPOLIS

Vacuum Tube Characteristics—(Continued)

(Continued from page 31)

The type 877 is a protective tube for use in B battery circuits as a protection against short circuits or faulty connections which might burn out other tubes or transformers.

The accompanying chart gives in detail the proper operating voltage and current consumption of the above listed tubes.

CARE OF TUBES

The vacuum tube is one of the most sensitive and delicate pieces of electrical apparatus ever devised and without it radio broadcasting and long distance broadcast reception would not be possible.

It is hard to realize the minute particles of energy that pass through the vacuum tube are rectified and amplified to sufficient volume to fill a room.

A very good comparison of energy is given by a well-known radio engineer who says, "The total amount of energy received by a receiving set from a station two thousand miles distant during a six-hour program is equivalent to the energy expended by a house fly in crawling four feet up a perpendicular wall."

Your tubes deserve the best possible care and with the proper attention will last indefinitely.

Do not overload them. Under no conditions use greater voltage on either the filament or the plate than those voltages recommended by the manufacturer. Excessive voltage applied to a tube will shorten its life and many times will cause the tube to become paralyzed. This is caused by over-heating the filament, which consumes the active material on the surface of the filament.

Some types and makes of tubes may be restored to full efficiency when this occurs. This is called rejuvenation, and the process is as follows:

The filament is heated to just below the melting point for a given length of time, which allows the active material in the center of the filament to come to the surface. The filament is then put through a baking process at approximately its normal temperature and the active material is firmly fixed on the surface. No plate voltage is applied to the tube during this process. Any reliable dealer can do this for you.

Handle your tube with care—a sharp jolt or jar may not break the filament, but is quite likely to disarrange the spacing of the elements, thereby affecting the operation of the tube.

Have your tubes tested regularly, or better still, secure a small, low-priced tester and test them yourself. If they are partially paralyzed and are of the proper type and manufacture, have them rejuvenated; you will be both surprised and pleased with the results.

Lastly, let me emphasize that your tubes are the heart of your radio set and you should know at all times their exact condition. A faulty tube will spoil an evening's entertainment. Purchase only good tubes made by reliable manufacturers and you will have the best results.

A Message to Radio Dealers and Manufacturers

MONEY on deposit with this institution, and property entrusted to its care, is assured the highest form of security. It is surrounded with all of the safeguards known to modern banking.

The Minnesota Loan and Trust Company, the oldest Trust Company in the Northwest, has a capital and surplus of \$2,000,000 and resources of approximately \$20,000,000. It is under the same stock ownership as the Northwestern National Bank.

THE MINNESOTA LOAN & TRUST CO
405 Marquette  Minneapolis

REPRESENTATIVES: ST. PAUL, 360 Robert Street

ROCHESTER, 19½ Second Street S. W.

DULUTH, 510 Alworth Building

Wave Band Allocations

Radio communication is going on at present on all wave lengths from 0 up to 3,158 meters. In order to give the radio listener somewhat of an idea of the vast uses of radio we are giving below the list of wave band allocations in use some time ago:



Meters	Service
3,158 to 2,500	Government CW and ICW exclusive.
2,500 to 1,910	Marine CW and ICW exclusive.
1,910 to 1,817	Point-to-point CW and ICW; marine CW and ICW.
1,817 to 1,579	Point-to-point CW, ICW, spark; marine CW and ICW.
1,579 to 1,304	Government CW and ICW exclusive.
1,304 to 1,277	University, college and experimental CW and ICW exclusive.
1,277 to 1,200	Marine, phone, non-exclusive.
1,200	Government, CW, ICW, non-exclusive.
1,200 to 1,091	Marine, phone, non-exclusive.
1,091 to 1,053	Marine, phone, non-exclusive.
1,053 to 600	Marine and coastal, including radio compass and radio beacons.
600 to 545	Aircraft CW, ICW, phone and fixed safety-of-life stations, phone, exclusive.
545 to 200	Broadcasting services, phone, exclusive.
200 to 150	Amateur, CW, ICW, phone.
150 to 137	Point-to-point, non-exclusive.
137 to 120	Aircraft, exclusive.
120 to 109.2	Mobile.
109.2 to 103.3	Relay broadcasting, exclusive.
103.3 to 85.6	Public service.
85.6 to 75.0	Amateur and army mobile.
75.0 to 66.7	Public service and mobile.
66.7 to 60	Relay broadcasting, exclusive.
60 to 54.5	Public service.
54.5 to 51.7	Relay broadcasting, exclusive.
51.7 to 42.8	Public service.
42.8 to 37.5	Amateur and army mobile.
37.5 to 33.3	Public service and mobile.
33.3 to 30	Relay broadcasting, exclusive.
30 to 27.3	Public service.
27.3 to 25.8	Relay broadcasting, exclusive.
25.8 to 21.2	Public service.
21.2 to 18.7	Amateur.
18.7 to 16.7	Public service and mobile.
16.7 to 5.3	Beam transmission.
5.3 to 4.7	Amateur.
4.7 to 0	Beam transmission.

Booths Built for Conventions
Home Coming and Street Decorations



Decorations

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**FILLMORE
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Decorators

**FLAGS, BUNTING AND
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MAXIMITE
TRADE MARK

LIVELY AND LASTING
FOR BEST RESULTS USE



Operating Over

WKBB—214.2 Metres
CFQC—330 Metres
CKY—384 Metres
CFDC—410.7 Metres
CFCF—410.7 Metres
CFCN—434.5 Metres

Owning and Operating CKCL—356.9 Metres
Wireless Dry Cells Limited

THE KOWFELDT COMPANY

529 Seventh Street So., Minneapolis, Minn.

Radio Terms—(Continued)

(Continued from page 34)

Farad: The unit of capacity.

Grid: A wire frame between the plate and filament of a vacuum tube.

Grid, Leak: A high resistance that permits excess grid charges to escape from the grid.

Ground: Electrical connection with the earth.

Honey Comb Coil: A set of three coils: primary, secondary and tickler, used for tuning. The primary coil is placed between the other two.

Hydrometer: In radio, an instrument used for testing the amount of charge in storage batteries.

Insulator: Material that will not allow passage of electric energy.

Impedance: Total opposition to the flow of current due to the resistance and inductance in a circuit.

Loop Aerial: Several turns of wire wound on a suitable frame.

Megohm: One million ohms.

Microfarad: One millionth of a farad.

Natural Wave Length: The length of wave through which the aerial responds due to its own capacity and inductance.

Potentiometer: Apparatus for varying voltage.

Primary Coil: Transformer coil which is connected to the source of supply.

Rectifier: Appliance which transforms alternating current to direct current.

Resistance: Opposition to the flow of an electrical current in a conductor.

Secondary Coil: Transformer coil in which current is induced.

Tickler Coil: Vacuum tube receiver circuit coil that transforms oscillating plate energy to grid circuit to strengthen plate circuit oscillation.

Transformer: An apparatus used to transfer energy from one circuit to another separate circuit by induction.

Variocoupler: An apparatus that varies the coupling between two circuits.

Variometer: A device which varies inductance in a circuit.

Wave Length: A distance between similar parts of two adjoining waves.

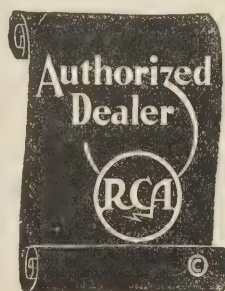
Volt: A unit of electrical pressure.

YOU wouldn't ride on solid tires! Why abide old fashioned radios? Hear the latest "ERLA (RFL)" a year ahead.



HALL SUPPLY CO.

253 3rd Ave. So.
MINNEAPOLIS



R C A
Receivers
Speakers
Tubes

Call the
COP(P)S

for

RADIO SETS
UPPLIES
SERVICE

Find Out About Our Year Service Contract

L. A. COPPS

1407 West Lake

Dy 4672



(Member N R T A)

RADIOLOG

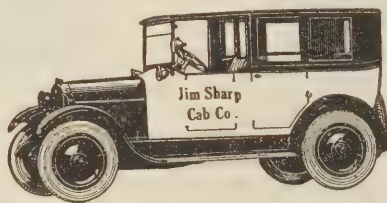
The 170 Most Active Stations in America

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
545	KFUO	St. Louis, Mo.....			
545	KSD	St. Louis, Mo.....			
535	KYW	Chicago, Ill.....			
535	WHA	Madison, Wis.....			
526	WHO	Des Moines, Iowa.....			
526	WNYC	New York City.....			
526	WOAW	Omaha, Nebr.....			
517	WJR	Detroit, Mich.....			
517	WCX	Detroit, Mich.....			
517	CJCA	Edmonton, Alta.....			
517	CNRE	Edmonton, Alta.....			
510	CYL	Mexico City.....			
508	KLX	Oakland, Cal.....			
508	WIP	Philadelphia, Pa.....			
508	WOO	Philadelphia, Pa.....			
500	WMC	Memphis, Tenn.....			
492	KGW	Portland, Ore.....			
492	WEAF	New York City.....			
484	WOC	Davenport, Iowa.....			
484	WSUI	Iowa City, Iowa.....			
476	WTIC	Hartford, Conn.....			
476	WFAA	Dallas, Texas.....			
476	WPAB	Fort Worth, Texas.....			
469	KFI	Los Angeles, Calif.....			
469	WCAP	Washington, D. C.....			
469	WRC	Washington, D. C.....			
461	WCAE	Pittsburgh, Pa.....			

Safety--Courtesy--Dignity

Pick One Up Anywhere or

Taxi



Phone
GEneva
5333

"YOU'VE TRIED THE REST,
NOW RIDE IN THE BEST"

JIM SHARP CAB CO.

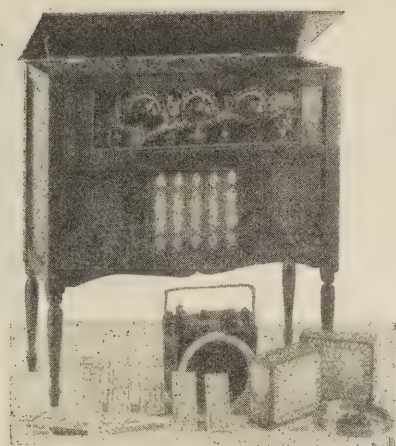
GEneva 5333

GEneva 5333

There Is the Log

← BUT

IT
→ TAKES
THE



TO
GET
THEM

APOLLO—THE GOD OF MUSIC
The Most Radio, Dollar for Dollar, in the United States

VISIT OUR SALES ROOM

APOLLO RADIO CO.

16 North Fourth St.
MINNEAPOLIS

Suite 502

Geneva 1879

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
454	KFOA	Seattle, Wash.....			
454	KTW	Seattle, Wash.....			
454	WJZ	New York City.....			
448	WMAQ	Chicago, Ill.....			
448	WQJ	Chicago, Ill.....			
441	WMAF	Dartmouth, Mass.....			
441	WOS	Jefferson City, Mo.....			
434	CFAC	Calgary, Alta.....			
434	CFCN	Calgary, Alta.....			
434	CNRO	Ottawa, Ont.....			
428	KPO	San Francisco, Calif.....			
428	WSB	Atlanta, Ga.....			
422	WLW	Cincinnati, Ohio.....			
416	WCCO	Minneapolis, Minn.....			
411	CFCF	Montreal, Que.....			
411	CHYC	Montreal, Que.....			
411	CKAC	Montreal, Que.....			
411	CKCD	Vancouver, B. C.....			
411	CNRM	Montreal, Que.....			
405	KHJ	Los Angeles, Calif.....			
405	WJY	New York City.....			
405	WOR	Newark, N. J.....			
400	WHAS	Louisville, Ky.....			
400	WHT	Chicago, Ill.....			
395	WFI	Philadelphia, Pa.....			
395	WLIT	Philadelphia, Pa.....			
395	WOAI	San Antonio, Texas.....			
394	KFRU	Bristow, Okla.....			
389	WEAR	Cleveland, Ohio.....			
389	WTAM	Cleveland, Ohio.....			
384	KJR	Seattle, Wash.....			
384	WMBF	Miami Beach, Fla.....			
384	CKY	Winnipeg, Man.....			
384	CNRW	Winnipeg, Man.....			

QUALITY RADIO

Let Us Demonstrate in Your Home
Magnavox—Ferguson—Thompson

Our Service Department Will Recondition
Your Favorite Set at an Unusual Low Cost

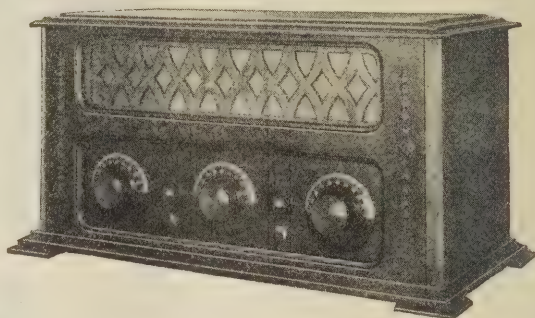
Call Geneva 1102

RADIO EQUIPMENT CORPORATION

113 South Sixth St.

Dealers Write for Our Catalogue of
Quality Parts, Kits and Accessories

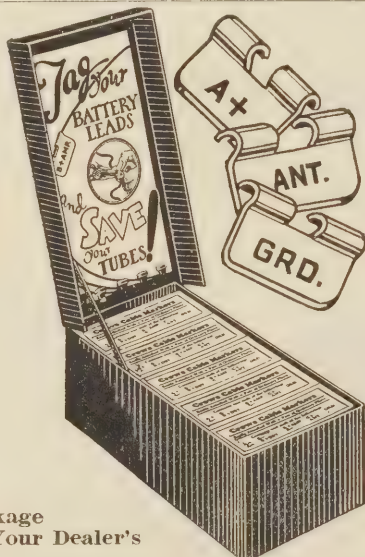
DOTSON SIX *The Ultimate Radio*



Gemco and Clear Speakers
Van Horne Tubes
French Ray-O-Vacs

**THE AUTOMOTIVE SUPPLY
CO.**

RIEBETH & INGMUNDSON
Distributors
Minneapolis



25c
the
Package
At Your Dealer's

INSURE YOUR TUBES WITH **Crowe Cable Markers**

Made of Metal—Bold, Black Markings
Easily Attached With Ordinary Pliers
Manufactured by Crowe Name Plate &
Mfg. Co., 1749 Grace St., Chicago

C. C. SCHWEISO
237 Plymouth Bldg. Minneapolis
Representative

NORTHEAST DISTRIBUTORS
For the Famous

5-Tube Set, \$60.00—6-Tube Set, \$70.00



Model 20 Compact

ATWATER KENT RADIO

All the New Models Now on Display
"Ask for Demonstration in Your Home—

And Let Us Explain Our Free
Service Plan"

It's Easy to Pay the Billman Way

BILLMAN'S
Furniture & Hardware
2504-10 Central Ave.

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
380	WGY	Schenectady, N. Y.			
380	WHAZ	Troy, N. Y.			
376	CKCK	Regina, Sask.			
375	KTHS	Hot Springs, Ark.			
370	WEBH	Chicago, Ill.			
370	WJJD	Chicago, Ill.			
366	WDAF	Kansas City, Mo.			
366	WHB	Kansas City, Mo.			
361	KGO	Oakland, Calif.			
361	WHN	New York City			
357	CFCA	Toronto, Ont.			
357	CHIC	Toronto, Ont.			
357	CHNC	Toronto, Ont.			
357	CNRT	Toronto, Ont.			
353	WJAD	Waco, Texas			
353	WWJ	Detroit, Mich.			
349	KOB	State College, N. M.			
349	WEEI	Boston, Mass.			
345	WCBD	Zion, Ill.			
345	WLS	Chicago, Ill.			
341	KSAC	Manhattan, Kans.			
341	WKAQ	San Juan, P. R.			
341	WMCA	New York City			
341	KFAB	Lincoln, Nebr.			
337	KFMX	Northfield, Minn.			
337	KNX	Los Angeles, Calif.			
337	WCAL	Northfield, Minn.			
333	WBZ	Springfield, Mass.			
326	WKRC	Cincinnati, Ohio			
326	WSAI	Cincinnati, Ohio			
322	KOA	Denver, Colo.			
322	WJAZ	Chicago, Ill.			
319	WGR	Buffalo, N. Y.			
319	WSMB	New Orleans, La.			

NATIONAL

HOMEPOWER "A" UNITS



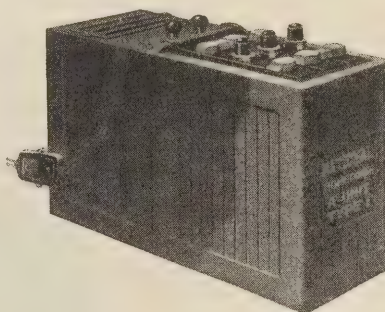
Volume, distance, clear reception—you get them in full measure with National "A" Radio Batteries. Neat, compact, leak-proof Batteries with containers that are built of a special, one-piece composition. Batteries that require water only four times a year, and are guaranteed for 18 months' service.

Type 1—\$28.00

Type 2—\$22.50

Type 3—\$21.00

Another "National" success! A combination "A" Battery and Charger in a single compact unit, fitted with a one-piece composition container which positively cannot corrode. No tin cans to be eaten away as in the ordinary charger outfit. Destructive gassing is reduced to a minimum in the National Homepower. Your cabinet and the delicate parts of your set remain unimpaired.



The National Homepower operates from ordinary house current and assures you full-powered "A" service every day of the year. Volume, distance, clarity, in full measure. And no more bothersome waits for recharge service; no more battery rental expense; no more dry cell renewals! See the National Homepower in its three types at your dealer's today!

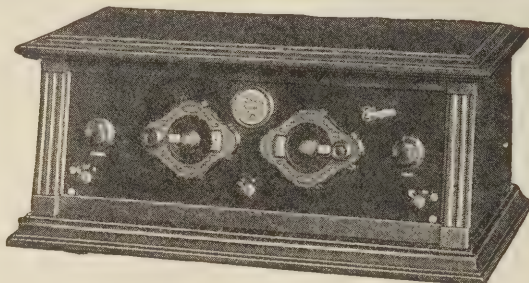
NATIONAL LEAD BATTERY CO.

General Offices: St. Paul, Minn.

Factories: St. Paul, Chicago, Kansas City, Los Angeles

Branches: New York City, Dallas, Oakland, Atlanta. Portland (Ore.), Baltimore

INTRODUCING
A New Series of Six-Tube Sets
Added to the Present Line of
CRESCENTYNE RADIO RECEIVERS



"Maintaining
THE STANDARD OF EXCELLENCE
For Radio Reception"

See Our Display at the Radio Show

THE CRESCENT RADIO MFG. CO.,
1026 Second Ave. S. Minneapolis, Minn.

When in Minneapolis Stay at



THE NEW NICOLLET HOTEL

Opposite Tourist Bureau on Washington Avenue

The Northwest's Finest Hotel

600 Rooms With Bath or Connecting

Every Room an Outside Room

Largest and Finest Ballroom in Northwest

Room Without Bath, \$2.00. Room With Bath, \$2.50 Up.

Home of WCCO Station

MAIN DINING ROOM—COFFEE SHOP

3 Blocks From Both Depots, Retail Center and Wholesale Center

W. B. CLARK, Manager

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
316	KFDM	Beaumont, Texas.....			
316	KPSN	Pasadena, Calif.....			
316	WAHG	Richmond Hills, N. Y.....			
316	WGBS	New York City.....			
312	CNRA	Moncton, N. B.....			
309	KDKA	East Pittsburgh, Pa.....			
306	KTCL	Seattle, Wash.....			
306	WJAR	Providence, R. I.....			
303	WGN	Chicago, Ill.....			
303	WLIB	Elgin, Ill.....			
300	KSL	Salt Lake City, Utah.....			
300	WPG	Atlantic City, N. J.....			
297	KPRC	Houston, Texas.....			
294	WBAV	Columbus, Ohio.....			
294	WEAO	Columbus, Ohio.....			
288	KFKX	Hastings, Nebr.....			
288	WLWL	New York City.....			
286	WREO	Lansing, Mich.....			
283	WOAN	Lawrenceburg, Tenn.....			
283	WSM	Nashville, Tenn.....			
280	WNAC	Boston, Mass.....			
280	KMOX	St. Louis, Mo.....			
278	WHDI	Minneapolis, Minn.....			
278	KOIL	Council Bluffs, Iowa.....			
278	KOP	Detroit, Mich.....			
278	KWWG	Brownsville, Texas.....			
278	WCAU	Philadelphia, Pa.....			
278	WGBU	Fulford, Fla.....			
278	WOQ	Kansas City, Mo.....			
275	KQV	Pittsburgh, Pa.....			
275	WBAK	Harrisburg, Pa.....			
275	WCEE	Elgin, Ill.....			
275	WHAD	Milwaukee, Wis.....			
275	WHAR	Atlantic City, N. J.....			

More Northwest Farmers Read

Farmstead, Stock & Home

THE DAKOTA FARMER
TRADE MARK REGISTERED
ESTABLISHED 1881

Than Any Other Two Farm Papers

Advertising in Farmstead, Stock & Home produces more radio sales per dollar because

1. Largest circulation of any farm paper in the Northwest with 160,000 subscribers. Covers the Twin City-Duluth trade territory where 58% of sets are sold to farmers.
2. Considered by farmers to be their radio authority due to several years of broadcasting and five years' effort to promote "radio on the farm."
3. Has done more to cooperate with radio jobbers and dealers than any other Minnesota farm paper.

In the Dakotas, 85% of radio sales are made to farmers. You can reach this great market best with advertising in The Dakota Farmer.

1. Largest circulation of any farm paper in the Dakotas—covers North and South Dakota with more than 75,000 subscribers.
2. Established in 1881, The Dakota Farmer has grown up with the country and has more influence on sales among farmers and radio distributors in the Dakotas than any other publication.
3. Carries more advertising than any other semi-monthly farm paper in the United States.

Sell Radio to 235,000 Farm Homes in Northwest

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
275	WJAS	Pittsburgh, Pa.			
275	WORD	Batavia, Ill.			
273	KWKH	Kennonwood, La.			
273	WEBJ	New York City.			
273	WFBH	New York City.			
270	KGU	Honolulu, T. H.			
270	WGHP	Detroit, Mich.			
270	WOI	Ames, Iowa.			
268	WTAG	Worcester, Mass.			
268	WNOX	Knoxville, Tenn.			
266	KFNF	Shenandoah, Iowa.			
266	WBCN	Chicago, Ill.			
266	WCAH	Columbus, Ohio.			
266	WENR	Chicago, Ill.			
266	WMAK	Lockport, N. Y.			
266	WWI	Dearborn, Mich.			
263	WAAM	Newark, N. J.			
263	WGWY	Minneapolis, Minn.			
261	WPSC	State College, Pa.			
258	WRNY	New York City.			
256	WRVA	Richmond, Va.			
252	KFWB	Hollywood, Calif.			
252	KFOY	St. Paul, Minn.			
252	WRHM	Minneapolis, Minn.			
252	KMA	Shenandoah, Iowa.			
252	WGCP	Newark, N. J.			
250	KDPM	Cleveland, Ohio.			
250	KFXF	Colorado Springs, Colo.			
250	WGES	Oak Park, Ill.			
250	WMBB	Chicago, Ill.			
246	KFWW	San Diego, Calif.			
244	WAMD	Minneapolis, Minn.			
242	KSO	Clarinda, Iowa.			
240	KFVE	St. Louis, Mo.			

DAY CALL
DINSMORE 1419



NIGHT CALL
(7 TO 9 P.M.)
HYLAND 4863

JALISCO RADIO SERVICE

Radio Installation and Repair Service

For Wholesaler, Dealer and Owner

We Service and Repair any make of receiver. When moving call us to reinstall your receiver. Our antennae stay up. Our service men are equipped with cars which carry tubes, batteries, antenna equipment and complete sets of testing instruments, which enable them to do their work quickly with positive results. Suburban service by car. Rural service by express.

The **Jalisco Monthly Inspection Contract** gives you a dependable arrangement for year-around maintenance of your radio receiver. Call or write us for further details.

TUBE REJUVENATION

229 East Hennepin Ave.

Minneapolis, Minn.

BECKWITH

PRESENTS

Federal **ORTHO-SONIC** *Radio*

Something New and Distinctive—Combines Beauty, Massiveness and Character—Single Dial or Centralized Control—
Phenomenal Power and Selectivity

MOHAWK RADIO

ONE DIAL CONTROL

Startling Values—A Price Range to Meet Every Pocketbook—
Accepted as One of Radio's Biggest Achievements.

Correspondence Invited

GEO. C. BECKWITH CO.

Wholesale Only

16 South Fifth St., Minneapolis

Authorized Exclusive Distributors for Federal Ortho-sonic, Mohawk Radio,
Standard Radio Equipment, Pathex Motion Picture Machines and
Victor Talking Machines

Wave Length	Call Letters	LOCATION	Dial Settings		
			1	2	3
238	WHT	Deerfield, Ill.			
229	KMMJ	Clay Center, Nebr.			
231	KFDZ	Minneapolis, Minn.			
226	WBBM	Chicago, Ill.			
226	WIBO	Chicago, Ill.			
217	WOK	Homewood, Ill.			
400	WHT	Chicago, Ill.			

Farrand
Speaker

FORMICA
Royal

Bremor
Tully

BENJAMIN
THOROLA

Sleeper **PHILCO** **CROSLEY** **Balkites**

THE BEST IN RADIO

Will Be In
Booths 35, 36, 37
25 No. 3rd St., Minneapolis

The ROYCRAFT Co.

ALL-AMERICAN
Runningham
RADIO TUBE

BILIER
G. Devices

BURGESS
RADIO BATTERIES

REMLER **UTAH**

List of Exhibitors

FIFTH ANNUAL NORTHWEST RADIO SHOW
September 27—October 2, 1926

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KFDM...316	WCX...517	WNOX...268
KFDZ...231	WDAF...366	WNYC...526
KFI...469	WEAF...492	WOAI...395
KFKY...288	WEAO...294	WOAN...283
KFMX...337	WEAR...389	WOAW...526
KFNF...266	WEBH...370	WOC...484
KFOA...454	WEBJ...273	WOI...270
KFOY...252	WEEL...349	WOK...217
KFRU...394	WENR...266	WOO...508
KFUO...545	WFAA...476	WOQ...278
KFVE...240	WFBH...273	WOR...405
KFWW...246	WFI...395	WORD...275
KFWB...252	WGBS...316	WOS...441
KFXF...250	WGBU...278	WPAB...476
KGO...361	WGCP...252	WPG...300
KGU...270	WGES...250	WPSC...261
KGW...492	WGHP...270	WQJ...448
KHJ...405	WGN...303	WRC...469
KJR...384	WGR...319	WREO...286
KLX...508	WGY...380	WRHM...252
KMA...252	WHA...535	WRNY...258
KMMJ...229	WHAD...275	WRVA...256
KMOX...280	WHAR...275	KSAC...341
KNX...337	WHAS...400	WSAI...326
KOA...322	WHAZ...380	WSB...428
KOB...349	WGWY...263	WSM...283
KOIL...278	WHB...366	WSMB...319
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KSO...242	WJAR...306	CFCA...357
KTCL...306	WJAS...275	CFCF...411
KTBS...375	WJAZ...322	CFCN...434
KTW...454	WJJD...370	CHIC...357
KWKH...273	WJR...517	CHNC...357
KWWG...278	WJY...405	CHYC...411
KYW...535	WJZ...454	CJCA...517
WAAM...263	WKAQ...341	CKAC...411
WAHG...316	WKRC...326	CKCD...411
WAMD...244	WLIE...303	CKCK...376
WBAK...275	WLIT...395	CNRA...312
WBAV...294	WLS...345	CNRE...517
WBBM...226	WLW...422	CNRM...411
WBCN...266	WLWL...288	CNRO...434
WBZ...333	WMAF...441	CNRT...357
WCAE...461	WMAK...266	CNRW...384
WCAH...266	WMAQ...448	CKY...384
WCAL...337	WMBB...250	PWX...400
WCAP...469	WMBF...384	CYL...510
WCAU...278		

MADERA CLEAR-SPEAKERS



The Madera Clear-speaker, made from all wood, producing unusual tone qualities. It speaks for itself. Insist on handling it.

No. 807 Mahogany, Equipped with Utah Unit.

Others Ranging From
\$10.00 to \$25.00

Radio Manufacturers note:

Also a complete line of the most wonderful cabinet speakers on the market—used by the better console radio manufacturers.

Ask us for information regarding style and dimensions.

MARING MAGNET WIRES



Conceded to be the most Uniform Magnet Wire used for coil winding.

Ask for free booklet showing exact diameter on all sizes, both plain and covered, and exact number pounds per 1,000 feet, etc,



FIBROC—BAKELITE

Panels—Sheets—Tubes—Rods

Will not absorb moisture.

Can be easily machined, punched or drilled without chipping.

Unequalled for Radio Manufacturers.

GRANT SALES COMPANY

Manufacturers' Representatives

1004 Marquette Ave., Minneapolis, Minn.

Phone Main 5778

See Our Exhibit at Booth No. 156

A BIT OF ADVICE

Coal Is of Vital Importance to Every Householder—Yet It Receives but Little Thought From the Majority

“SEND ME A TON OF HARD COAL”

Is a Common Expression. As if Hard Coal Were a Staple Commodity That Did Not Vary in Quality or Kind

Coal Should Be Bought After Careful Investigation

And if Careful Investigation Is Made OZARK Hard COAL Will Be Chosen Because:

1. It is freshly mined Arkansas Hard Coal.
2. It is free from smoke, soot, slate, stone.
3. It is handled by responsible dealers.
4. It is unqualifiedly guaranteed.
5. It leaves very little ash.
6. It burns uniformly and is long lasting.
7. It is over \$2.00 per ton cheaper than ordinary hard coals.

THE PRICE, \$15.75 PER TON

Your Dealer Should Have It. If Not, Phone Us.

H. M. BOYER COAL COMPANY

NORTHWESTERN DISTRIBUTOR

404 Lumber Exchange

Atlantic 0480

Installation Rules for Receiving Stations

FIRE UNDERWRITERS RULES, 1923

ARTICLE 37. RADIO EQUIPMENT

3701. General.

a. The requirements of this article shall not apply to equipment installed on ship-board, but shall be deemed to be additional to, or amendatory of, those prescribed in articles 1 to 19, inclusive, of this code.

b. Transformers, voltage reducers, keys and other devices employed shall be of types expressly approved for radio operation.

3702. For Receiving Stations Only.

a. Antenna and counterpoise outside buildings shall be kept well away from all electric light or power wires of any circuit of more than 600 volts, and from railway, trolley or feeder wires, so as to avoid the possibility of contact between the antenna or counterpoise and such wires under accidental conditions.

b. Antenna and counterpoise where placed in proximity to electric light or power wires of less than 600 volts, or signal wires, shall be constructed and installed in a strong and durable manner, and shall be so located and provided with suitable clearances as to prevent accidental contact with such wires by sagging or swinging.

c. Splices and joints in the antenna span shall be soldered unless made with approved splicing devices.

d. The preceding paragraphs a, b, and c, shall not apply to light and power circuits used as receiving antenna, but the devices used to connect the light and power wires to radio receiving sets shall be of approved type.

e. Leadin conductors shall be of copper, approved copper-clad steel or other metal which will not corrode excessively, and in no case shall they be smaller than No. 14, except that bronze or copper clad steel not less than No. 17 may be used.

f. Leadin conductors on the outside of buildings shall not come nearer than 4 inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor which will maintain permanent separation. The non-conductor shall be in addition to any insulating covering on the wire.

g. Leadin conductors shall enter the building through a non-combustible, non-absorptive insulating bushing slanting upward toward the inside.

h. Each leadin conductor shall be provided with an approved protective device (lightning arrester) which will operate at a voltage of 500 volts or less, properly connected and located either inside the building at some point between the entrance and the

set which is convenient to a ground, or outside the building as near as practicable to the point of entrance. The protector shall not be placed in the immediate vicinity of easily ignitable stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

i. If an antenna grounding switch is employed, it shall in its closed position form a shunt around the protective device. Such a switch shall not be used as a substitute for the protective device.

j. If fuses are used, they shall not be placed in the circuit from the antenna through the protective device to ground.

Fuses are not required.

k. The protective grounding conductor may be bare and shall be of copper, bronze, or approved copper-clad steel. The grounding conductor shall be not smaller than the leadin conductor and in no case shall be smaller than No. 14 if copper nor smaller than No. 17 if of bronze or copper-clad steel. The grounding conductor shall be run in as straight a line as possible from the protective device to a good permanent ground. Preference shall be given to water piping. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building, and artificial grounds such as driven pipes, rods, plates, cones, etc. Gas piping shall not be used for the ground.

l. The protective grounding conductor shall be guarded where exposed to mechanical injury. An approved ground clamp shall be used where the grounding conductor is connected to pipes or piping.

m. The grounding conductor may be run either inside or outside the building. The protective grounding conductor and ground, installed as prescribed in the preceding paragraphs k and l, may be used as the operating ground.

n. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than 2 inches to any electric light or power wire not in conduit unless separated therefrom by some continuous and firmly fixed non-conductor, such as porcelain tubes or approved flexible tubing, making a permanent separation. This non-conductor shall be in addition to any regular insulating covering on the wire. Storage battery leads shall consist of conductors having approved rubber insulation.

The above is reprinted from "Safe Practice Pamphlet" No. P. S. 1, published by the National Safety Council.

AN APPRECIATION

The dealer and jobber members of the Northwest Radio Trade Association wish to express their hearty appreciation for the support given our show and our official program by the National Radio Manufacturers who are exhibiting in the show and advertising in Northwestern publications. Their support is very largely responsible for the great success of the Radio Show and Annual Convention.

The management of the show urges dealers, jobbers, and the public to reciprocate by purchasing the radio equipment manufactured by our friends, who have so kindly given us their support. The association will be glad to inform any parties of the extent of co-operation given to the Northwest Radio Trade Association by various manufacturers.

Farrand **Speaker** **RAY-DIAC** **Sleeper** **PHILCO** **CROSLEY** **Balkites** **SM**
THE BEST IN RADIO
Will Be In
Booths 35, 36, 37
25 No. 3rd St., Minneapolis
FORMICA **Royal** **Benjamin** **Premer** **THOROLA** **The ROYCRRAFT Co.** **REMLER** **UTAH** **BURGESS** **TUBE** **ALL-AMERICAN** **Runningham** **RADIO**

EVEREADY

Radio Batteries

—they last longer



SEE OUR COMPLETE DISPLAY IN THE FIFTH ANNUAL
RADIO SHOW. OUR REPRESENTATIVES WILL BE
GLAD TO DISCUSS YOUR RADIO PROBLEMS WITH YOU



NATIONAL CARBON COMPANY, INC.

New York

San Francisco

Why a Lightning Arrester

BY G. C. KOWFELDT,
OF THE L. S. BRACH MFG. CO.

Contrary to the belief of some people, every exposed radio aerial is subject to the inductive influence of lightning discharges, yet whatever hazard exists can be easily nullified. To understand the fundamental principle of lightning does not require a knowledge of electricity. Let us explain this phenomena; also outline how a dangerous current which may be attracted to the radio aerial can be diverted harmlessly into the earth.

WHAT IS LIGHTNING?

Lightning is electrical energy that has accumulated in the clouds. This accumulation of high electrical power is brought about through sudden changes in atmospheric temperature. The power is gradually built up in the clouds until finally it becomes so great an energy that it passes through space to other clouds or to the earth where it is neutralized. When we see a lightning flash, we see the effects of the passing of this electrical energy from cloud to cloud or from cloud to earth and in the passing of this energy, the air is disrupted and a tremendous air vibration is set up, resulting in what we term thunder.

When electricity passes from one point to another, it sets up a condition known as induction; that is, it creates another current in a parallel intervening space. This space may be termed the area of electrification. When lightning passes from cloud to cloud or from cloud to earth, this energy also sets up a highly inductive condition—that is, a wide area and this area may also be termed as the area of electrification; and all exposed wires will pick up energy by induction. The amount of energy picked up in a radio aerial will vary, depending on the distance from the lightning discharge and the intensity of that discharge.

In other words, when a lightning flash is a considerable distance away, the induction picked up in a radio aerial is negligible in fact absolutely harmless and its only evidence is present in the slight click in the headset or loudspeaker when the radio is operated. However, when a discharge of lightning occurs in close proximity to the aerial, it may become evident in many ways and be capable of doing considerable damage to the radio set.

For example—this induction may destroy the insulation of the delicate wiring of some part of the radio set, spoiling its efficiency or

actually destroying the operating parts of the set. It may injure condensers, blow up the arrester, destroy your antenna or be capable of starting a fire. It is not necessary for lightning to actually hit a wire to cause the damage referred to as this damage has already occurred by reason of induction or presence in the area of electrification.

To protect against the possibilities of such damage, an electrical instrument was designed and termed "lightning arrester." What an arrester actually does is to change the path of the lightning inductive discharge, diverting it from the radio set, where it would be liable to do harm, into the earth where it becomes lost and where no damage can result.

PRINCIPLE NOT NEW

Lightning arresters are not new in any field of electricity—many millions are used by telephone and telegraph, police and fire alarm, railway signals, and in fact by every branch of electricity which employs exposed wires. There are a great many different kinds of lightning arresters. All of them are not practical for the protection of radio aerials—in fact to design a lightning arrester that may be considered ideally suited to protect a radio aerial requires experience in the manufacture of lightning protective apparatus.

TO PROTECT A RADIO AERIAL

The arrester must be extremely sensitive. By this we mean that since the radio instrument itself is a highly sensitive instrument to the influence of electrical current, in order that it be properly protected, the arrester must be of greater sensitiveness, otherwise there would be no protection. Furthermore, the arrester must be capable of diverting into the earth energy of considerable volume otherwise this energy would divide and part of it still enter the radio set and do damage. In addition to these qualities, the arrester must be free from giving trouble to the radio by becoming short circuited, grounded or leaky, in which case the radio would become troublesome and you would lose the benefit and pleasure that you formerly enjoyed from the set.

ARRESTERS THAT PROTECT

The proper type of lightning arrester to use is one which cannot become grounded or leaky, one that is extremely sensitive to any abnormal current and still is capable of diverting to the ground a high inductive charge.

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LOCATING TROUBLE

The Following Chart Has Been Prepared to Facilitate Locating and Correcting Trouble in Radio Receivers

NO RECEPTION

SYMPTOM	POSSIBLE CAUSES	REMEDIES
Tubes fail to light.	The battery may not be connected.	Inspect wires from battery to receiver.
	A battery may be run down.	Recharge storage or replace dry cells with new batteries.
	One or more tubes burned out.	Replace with good ones.
	Broken A battery wires or loose A battery connections.	Trace entire wiring from A battery; make certain all connections are tight.
	Tube socket springs bent so that no contact is made with tube pins.	Examine sockets. Bend socket springs to normal position so that when tube is inserted connection will be made with pins.
If tubes burn dimly.	If tube adapters are used, circuit may be open due to a bent spring connector.	Turn on A battery; slowly move tube about in socket. If it lights it is evident that the socket pin is not making good contact with the adapter or the adapter with the socket springs.
	The A battery may be weak.	Test and recharge storage battery or replace dry cells with new ones.
	Loose connection in A battery wiring.	Trace wiring and make sure that all connections are tight.
Tubes burn at normal brilliancy but no signals are audible in speaker or headphones.	No station within range of your set may be broadcasting at the time you are testing the receiver.	
	Run-down B battery.	Test with voltmeter; replace with new one if 45-volt battery registers less than 35 or the 22½-volt battery less than 17.
	One of B battery leads may be disconnected as result of loose or broken wire.	Check B battery wiring from batteries to receiver.
	B batteries may be improperly connected together or to receiver.	Make sure that positive of battery is connected to positive terminal of set and negative of battery to negative receiver binding post. Batteries should be connected negative to positive.
	Tubes may be paralyzed from having been burned too brightly or from too much B battery being used.	May be restored to usefulness through rejuvenation. If no rejuvenator is available disconnect B batteries and light filaments for twenty minutes. Connect B batteries.
	Too much detector B battery voltage.	Try using a lower voltage tap on the B battery.
	Connecting cord between receiver and headphones or loudspeaker may be broken.	Turn on set and listen while double-bending every part of the entire length of the cord. A "click" will be heard when the break is found. Cords are not easily repaired. Replace with new one. Cord tips may be loose in plug or at headphone or speaker end.
	Jack springs may be bent so that they do not make connection with the phone or speaker plug.	Examine and make sure that all connections are tight.
	Detector tube may be misplaced in amplifier socket.	Remove tubes and examine type number stamped on bases.
Crysta. set.	Crystal may be dirty or burned out.	Clean with alcohol and brush. Replace. Do not touch crystal with fingers.

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WEAK SIGNALS

SYMPTOM	POSSIBLE CAUSES	REMEDIES
(After set has been in use some time.)	Batteries may be nearly exhausted.	Test storage batteries with hydrometer; dry cells with voltmeter. Recharge or install new ones.
	Tubes may have lost their efficiency.	Follow instructions above for rejuvenation.
	Rheostat may not be turned on far enough.	Try turning rheostat farther "on." If this does not correct the trouble return to original adjustment. Burning tubes too brightly will damage tubes.
	Set may not be tuned to exact wave length of transmitting station.	Adjust controls.
Weak signals, low whistle audible accompanied by crackling sounds.	Run-down B batteries.	Try changing tubes around in set.
Signals loud when set is turned on but gradually become weaker.	A battery run down.	Recharge storage batteries. Install new dry cell B batteries.
Signals noticeably weak during or after a rain.	Defective insulators, cracked or dirty; corroded connection where lead-in connects with antenna; lead-in may be touching metal which absorbs radio energy.	Recharge storage batteries if hydrometer test shows reading of 1,200 or less. Replace dry-cell batteries showing ammeter test of 15 or less.
Signals louder on spare headphones than on pair regularly used.	First set has lost its magnetism possibly as a result of being dropped.	Clean insulators. Replace cracked ones; make certain that lead-in makes perfect connection with antenna. Inspect lead-in and fasten if necessary to prevent contact with any uninsulated object.
Weak signals and poor quality first time speaker is connected.	Reversed polarity.	Communicate with manufacturers for approximate cost of repairs or else replace with new set.
	Volume control out of adjustment.	Reverse headphone or loud-speaker cord connections by removing tips and replacing in reverse order. One connection will give better quality than the other.
Crystal set—sensitive spots difficult to locate.	Mineral may be burned out or else coated with dirt.	Adjust volume control.
		Clean with alcohol. Do not handle with the fingers. If this does not help break off a piece and try one of the inner surfaces.

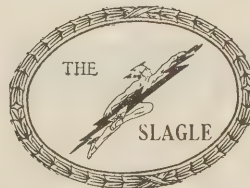
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UNSTEADY, WAVERING OR NOISY RECEPTION

SYMPTOM	POSSIBLE CAUSES	REMEDIES
Fluctuating signals.	May be due to fading.	An atmospheric condition for which there is no remedy.
Clicks noticeable when headphone cord is moved or when set is jarred.	Broken headphone cord or loose wire in receiver.	Listen with receiver in operation, moving one wire and another inside the set until defective one is located. Solder or splice.
Ringling noise in the set when set is jarred or tubes are accidentally touched.	Microphonic tubes. Sound is the result of vibration of the elements within the tube.	Try changing the tubes around in the sockets; If the set is not equipped with cushion sockets the trouble may be partly overcome by placing the set on cushions of eraser rubber.
Continuous squeal in set regardless of all possible adjustments but not audible in detector circuit.	C battery run down or else improperly connected.	Test C battery. Replace with new one if run down.
Popping, crackling noises which begin soon after set has been turned on.	Run-down B batteries or static.	Test and replace with new one. No way to prevent static. May be somewhat reduced by use of an indoor antenna consisting of one or more turns of flexible insulated wire suspended around ceiling of room in which the set is located
Two or more stations audible at same time.	Set may be improperly tuned. One of the broadcasters may not be adhering strictly to assigned wavelength.	Try close adjustment of tuning controls. If it is a regular occurrence, connect a wave trap in series with antenna and receiver. Reducing length of outdoor antenna will improve selectivity at cost of slight decrease in signal volume.
Continuous whistle audible only when certain stations are tuned in, may have slight variation in tone.	Two stations broadcasting on very close wavelengths.	No remedy. Tune in another station.
Intermittent whistle.	May be due to the operation of a radiating receiver in the neighborhood.	No remedy at receiving end.
Cannot eliminate signals from near-by station.	Either located too close to the broadcaster or else antenna is too long to permit selective reception.	Use wave trap. Install a loop receiver. Reduce length of antenna.
Scraping, raspy sounds noticeable when set is being tuned.	Dust on and between variable condenser plates.	Remove with the aid of a pipe-stem cleaner
	Swinging antenna or lead-in.	Tighten by fastening to building with insulators and guy wire.
Rapid fading in and out of signals.	Natural fading.	No remedy.

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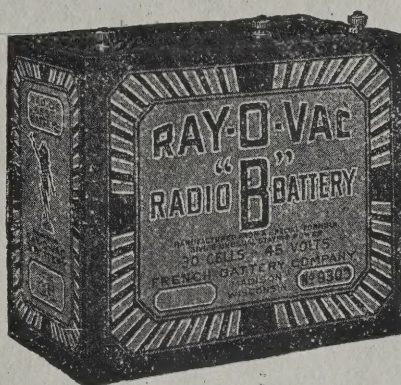
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